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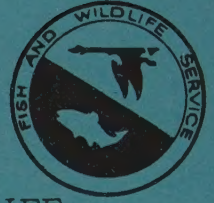
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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of papers on limnology, ecology, natural history and other fields of specialization will be included when the subject has application to the conservation of sport fish and the restoration of sport fishing.

One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes.

The last number of each volume contains a list of publications screened for appropriate material. Suggestions for improving the usefulness and coverage of Sport Fishery Abstracts are solicited.

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**Prepared in the Branch of Federal Aid
S. E. Jorgensen, Chief
Donald F. LaPointe, Editor
Geneva T. Thompson, Asst. Editor**

3143. Powers, Charles F., and John C. Ayers. 1960. WATER TRANSPORT STUDIES IN THE STRAITS OF MACKINAC REGION OF LAKE HURON. *Limnology and Oceanography*, Vol. 5, No. 1, pp. 81-85.

The Straits of Mackinac comprise five simple straits in the region embracing Mackinac Island, Round Island, Bois Blanc Island, and the adjacent portions of the Upper and Lower Peninsulas of Michigan. Here the inflows from Lakes Michigan and Superior enter Lake Huron. Direct assessments of the inflow from Lake Michigan and of the run-off from the Lake Huron watershed, hitherto obtainable only by indirect means, have been made. The study indicates that large volumes of water move horizontally in oscillatory motion, due to the action of the Lake Michigan-Lake Huron uninodal seiche, but that this motion has no effect upon the flow-through of waters from the upper lakes through Lake Huron. The excess of oscillatory transport over net flow-through indicates the seiche has an amplitude of about 0.1 m, a value which is independently confirmed by data from the literature. (Auth. abst.)

3144. Buck, John D., and Robert C. Cleverdon. 1960. THE SPREAD PLATE AS A METHOD FOR THE ENUMERATION OF MARINE BACTERIA. *Limnology and Oceanography*, Vol. 5, No. 1, pp. 78-80.

A comparison was made of agar plates spread with glass rods and poured agar plates for the enumeration of bacteria in the waters of Fisher's Island Sound, salinity 30 ‰. Spread plates were shown to be markedly superior. Highest counts were obtained by spreading, using rods treated with Desicote (a silicone solution) and incubating plates at 25°C, rather than at 16°C, and in air rather than in air with CO₂ content increased. (Auth. abst.)

3145. McNabb, Clarence D. 1960. ENUMERATION OF FRESHWATER PHYTOPLANKTON CONCENTRATED ON THE MEMBRANE FILTER. *Limnology and Oceanography*, Vol. 5, No. 1, pp. 57-61.

Individuals of the phytoplankton become distributed at random when concentrated on the membrane filter. The percentage of microscopic fields in which a species occurs may therefore be validly converted to a theoretical average number of individuals per field. The theoretical density thus obtained and the actual density determined by time-consuming counting are very nearly similar values when 25 or more fields are scored. An enumeration technique using this relationship is described. It has many advantages over commonly used procedures for concentrating the plankton and estimating the number of individuals in a sample. (Auth. abst.)

3146. Pearson, Erman A., and George A. Holt. 1960. WATER QUALITY AND UPWELLING AT GRAYS HARBOR ENTRANCE. *Limnology and*

Oceanography, Vol. 5, No. 1, pp. 48-56.

The incoming ocean water entering Grays Harbor, Washington on flood tide was observed periodically to contain abnormally low dissolved oxygen concentrations. Low dissolved oxygen concentrations (≈ 5.0 mg/L or 3.5 ml/L) were associated generally with significantly lower than normal ocean water temperatures which presumably results from upwelling along the coast. On a given tidal cycle the oxygen deficiency from normally assumed saturation levels for ocean water is equivalent to the oxygen demand associated with the domestic sewage discharge of 20 million persons. It appears that upwelling phenomena may negate conclusions based on oxygen balances in pollutional analyses of estuaries unless the actual dissolved oxygen concentration at the ocean source is determined. (Auth. abst.)

3147. Ramsey, W. L. 1960. DISSOLVED OXYGEN IN SWEETWATER LAKE. *Limnology and Oceanography*, Vol. 5, No. 1, pp. 34-42.

In Sweetwater Lake, near San Diego, California, vertical distribution of dissolved oxygen was observed to be highly stratified during the early summer months. With the lake at a maximum depth of about 32 ft., the lower 5 to 10 ft. were devoid of oxygen by early July but mid-depths and upper levels remained well-oxygenated throughout the period of observation. The pattern of oxygen distribution in the lake appeared to reflect the prevailing summer circulation which consisted of rapid down-wind movement at the surface with counter-currents at mid-depths and smaller circulation cells at lower depths. Rising summer temperatures caused an increase in the depth of the upper layer of water saturated or supersaturated with oxygen. The drop in solubility of oxygen due to heating of the surface layers of water was proportionally greater than the decrease in oxygen content, producing an increase in saturation values. Thermal stratification seemed to be sufficient, by reduced vertical mixing, to maintain the lake in a condition of oxygen-rich epilimnion and oxygen-depleted hypolimnion.

Serial observations showed a diurnal cycle of rising oxygen content in the surface layers in late afternoon and evening, probably the results of the photosynthetic activity of the phytoplankton and the circulation of high oxygen water from the shallow end of the lake.

Simultaneous sampling of the water at various depths for oxygen analysis and measurement of light transmission with a hydrophotometer produced no correlation between oxygen content and turbidity. Simultaneous measurement of sound velocity, attenuation and oxygen content also produced no conclusive results. (Auth. abst.)

3148. Gorham, Evile. 1960. CHLOROPHYLL DERIVATIVES IN SURFACE MUDS FROM THE ENGLISH LAKES. *Limnology and Oceanography*, Vol. 5, No. 1, pp. 29-33.

Chlorophyll derivatives, total carbon, and total sulfur have been estimated in surface muds from

the depths of five widely differing bodies of water. All three components increase in passing from muds of large infertile lakes, with waters low in phytoplankton and poor in lime and potash, to muds of smaller and more fertile lakes, with big phytoplankton crops and more plentiful supplies of lime and potash in their waters. Certain differences in the absorption spectra of acetone extracts may be related to the balance between organic materials originating inside and outside the lakes, and to the length of time they spend in an oxidizing environment. (Auth. abst.)

3149. Harms, Clarence E. 1959. CHECKLIST OF PARASITES FROM CATFISHES OF NORTH-EASTERN KANSAS. Transactions of the Kansas Academy of Science, Vol. 62, p. 262.

3150. Kawanabe, Hiroya. 1959. FOOD COMPETITION AMONG FISHES IN SOME RIVERS OF KYOTO PREFECTURE, JAPAN. Memoirs of the College of Science, University of Kyoto, Series B, Vol. XXVI, No. 3, Article 3 (Biology), 1959, pp. 253-268.

The standing crops of bottom algae and benthic invertebrates as well as the population and the food of fishes were studied in the middle course of four rivers in Kyoto Prefecture, with the following results.

(1) The stomach contents of freshwater fishes change in accordance not only with the composition and amount of their food substances but also with the composition and population of the fish society itself.

(2) The food segregation, which is forced by the social relation among fishes, indicates the existence of severe interspecific competition. (Auth. summ.)

3151. Filice, Francis P. 1959. THE EFFECT OF WASTES ON THE DISTRIBUTION OF BOTTOM INVERTEBRATES IN THE SAN FRANCISCO BAY ESTUARY. The Wasmann Journal of Biology, Vol. 17, No. 1, pp. 1-17.

The data from 312 collecting stations were examined. The distribution of natural variables among the various polluted areas was studied to eliminate the possibility that the regular variation of one of these might impose a spurious regularity into the relationship between pollution and the fauna. It was shown that these natural variables are random with respect to the categories of pollution and hence can be disregarded in the present context. The distortion of the normal fauna in the various pollution categories is summarized as follows:

1. Normal bottom - This was sampled at 154 stations from which were taken 39 species at an average of 6.5 species in every 10 liters of dredged bottom. Half of these species grow in large numbers in the vicinity of domestic pollution and twelve species were never found in an area exposed to wastes.

2. At industrial outfalls - This waste category was sampled at 8 stations from which 3 species

were taken at an average of 1 species in every 10 liters of substrate. Only Rhithropanopeus harrisi occurred in numbers in any way comparable with the numbers predicted by a chance distribution hypothesis. This tolerance to a highly toxic environment is discussed.

3. Marginal to industrial outfalls - This habitat was sampled at 39 stations at which 12 species were taken at an average of 3 species per 10 liters of substrate. Two of these species Rhithropanopeus harrisi and Nereis succinea, are indifferent to this environment in that they appeared in predictable numbers. Nereis lighti (= Nereis limnicola Johnson) appeared in numbers greater than predicted but this is attributable to an anomaly in the collection method.

4. At domestic outfalls - This was sampled at 13 stations which yielded 5 species at an average of 2 species in every 10 liters of bottom. Only Rhithropanopeus harrisi and Capitella capitata were found here in numbers larger than expected.

5. Marginal to domestic outfalls - This was sampled in 98 station from which 30 species were taken at an average of 11.5 species in every 10 liters of substrate. This habitat is preferred, in terms of numbers of collected specimens, by 77 percent of these species. Seven of the species that were taken here are present in decreased numbers. No species could be called "indifferent" to this polluted environment.

The difference in waste tolerance among related species is discussed.

3152. Holmes, W. N., and Gael H. Stott. 1960. STUDIES OF THE RESPIRATION RATES OF EXCRETORY TISSUES IN THE CUTTHROAT TROUT (SALMO CLARKI CLARKI). I. VARIATIONS WITH BODY WEIGHT. Physiological Zoology, Vol. XXXIII, No. 1, pp. 9-14.

Oxygen consumptions of kidney and gill tissues of cutthroat trout (Salmo clarki clarki) were examined in relation to body weight.

A decline in weight specific oxygen consumption with increase in body weight for both tissues was observed (kidney -0.148, gill -0.139). This decline was not significantly different for the two tissues.

The regression coefficients of Q_{O_2} values for kidney and gill tissue (-0.148 and -0.139) were statistically compared to a theoretical value of -0.27, which would correspond to the 0.73 rule. Such comparison showed a highly significant difference ($p < 0.005$, > 0.001), indicating that the decline in metabolism of these tissues with increasing body weight is not according to the 0.73 rule. (Auth. summ.)

3153. Holmes, W. N., and Gael H. Stott. 1960. STUDIES OF THE RESPIRATION RATES OF EXCRETORY TISSUES IN THE CUTTHROAT TROUT (SALMO CLARKI CLARKI). Physiological Zoology, Vol. XXXIII, No. 1, pp. 15-20.

Cutthroat trout (Salmo clarki clarki) were transferred from fresh water to 65 percent standard sea water. The oxygen consumptions of kidney and gill

tissues were examined during a 168-hour period after transfer.

A sharp initial rise in Q_{O_2} of kidney tissue was noted during the first 48 hours after transfer, reaching a maximum at 20 hours. The tissue respiration during the rest of the experimental period remained significantly higher than the parallel control level.

The gill-tissue respiration declined rapidly during the first 10 hours after transfer and remained significantly below the control level for the whole experimental period.

The results are discussed in relation to recent observations concerning possible hormonal regulation in euryhaline species of salmonoids. (Auth. summ.)

3154. Leslie, P. H. 1959. THE PROPERTIES OF A CERTAIN LAG TYPE OF POPULATION GROWTH AND THE INFLUENCE OF AN EXTERNAL RANDOM FACTOR ON A NUMBER OF SUCH POPULATIONS. *Physiological Zoology*, Vol. XXXII, No. 3, pp. 151-159.

In this paper we shall consider the growth in numbers of a population of a single species, living in a limited environment, in which it is assumed that the fertility and mortality of each age-group depend not only on the existing state of the population at some given time t but also on the state of the population at some previous time $t - x$, when the individuals forming a particular age-group, aged between x and $x + \Delta x$, were born. This is partly a "lag" form of population growth in which the period of lag varies from age-group to age-group depending on the length of time the individuals have lived in the population. It is shown that this type of population, living under optimum constant conditions as regards the environment, would oscillate in numbers, the amplitude of the oscillations, which initially may be quite marked, gradually dying out as an approach is made to the stationary state in numbers.

A further problem which is considered is the influence of an external seasonal factor on a number of oscillating populations of this type, which are situated in the same geographic region. This common factor is here regarded as being a hierarchy of five possible classes of "season", ranging from "very good" to "very bad," which are assumed to follow one another in a random order. It appears that the effect of an external random factor of this type, acting independently of age and numbers, is to bring the oscillations of such geographically isolated systems gradually into phase. (Auth. intro. and summ.)

3155. McCleary, Robert A., and Jerald J. Bernstein. 1959. A UNIQUE METHOD FOR CONTROL OF BRIGHTNESS CUES IN STUDY OF COLOR VISION IN FISH. *Physiological Zoology*, Vol. XXXII, No. 3, pp. 284-292.

1. The goldfish is capable of red-green hue discrimination under experimental conditions which rule out the possibility that brightness cues

are being employed.

2. The goldfish is capable of stimulus generalization involving either hue or brightness characteristics of stimuli. (Auth. summ.)

3156. Grimm, Robert J. 1960. FEEDING BEHAVIOR AND ELECTRICAL STIMULATION OF THE BRAIN OF *CARASSIUS AURATUS*. *Science*, Vol. 131, No. 3394, p. 162.

Bipolar electrodes were implanted in large goldfish in olfactory and nonolfactory areas of the central nervous system. Stimulation of olfactory areas elicited stereotyped feeding activity indistinguishable from normally induced behavior. It is suggested that the olfactory rather than the peripheral gustatory system plays the predominant role in the arousal of feeding activity. (Auth. abst.)

3157. Haskell, William L. 1959. DIET OF THE MISSISSIPPI THREADFIN SHAD, *DOROSOMA PETENENSE* ATCHAFALAYAE, IN ARIZONA. *Copeia*, No. 4, pp. 298-302.

The major items in the diet of adult threadfin shad in Lake Carl Pleasant during the winter months of 1957-1958 were algae, the principal constituents being diatoms and the unicellular green species. Spring sampling of Saguaro Lake and summer sampling of Bartlett Lake in 1958 show animalculae to be a major food item, the greatest bulk being rotifers and crustaceans. Lesser quantities of the algal forms continue to occur regularly in the spring and summer samples.

Contents of samples suggest that two principal methods of feeding occur. Both apparently utilize the gill filaments as a strainer to segregate material from the water for ingestion. The chief indicated difference between the two is the source of materials: one takes material from the bottom of the body of water whereas the other is a true pelagic plankton-feeding operation taking place at any level where organisms are satisfactorily abundant. The constant presence of fresh-appearing intact pelagic algae in stomachs, and debris consisting of particles of sand and bits of wood, suggests that the threadfin shad consistently engages in both methods. (Auth. summ.)

3158. Sathyanesan, A. G. 1959. SEASONAL HISTOLOGICAL CHANGES IN THE TESTIS OF THE CATFISH *MYSTUS SEENGHALA* (SYKES). *Journal of the Zoological Society of India*, Vol. 11, No. 1, pp. 52-59.

In the adult *M. Seenghala* the sexes can be distinguished with ease.

The posterior one-fourth of the testis is sterile and is formed of network of cavities, homologous to the structure described in the young teleosts which bear semblance to the condition obtaining in *Polypterus*. The functional part of the testis during its seasonal cycle exhibits a period of activation, growth, maturity, depletion and rest. The interstitial cells exhibit some apparent variations during the pre-spawning and spawning periods, for which it is difficult to draw any functional correlations.

This species breeds in the river Ganges from

March to May. The late spawners encountered are not taken into account. Temperature appears to be an environmental factor influencing spawning. A correlation between the variations in the condition factor value and the stages in the seasonal cycle of the testis is attempted. (Auth. summ.)

3159. Swarup, H. 1959. ABNORMAL DEVELOPMENT IN THE TEMPERATURE TREATED EGGS OF *GASTEROSTEUS ACULEATUS* (L.); II. GASTRULATION ABNORMALITIES. Journal of the Zoological Society of India, Vol. 11, No. 1, June, 1959, pp. 1-6.

Gastrulation abnormalities appear when freshly fertilized eggs of *G. aculeatus* are subjected to high or low temperatures. The abnormalities noticed are the formations of (i) only anterior part of head, (ii) spina bifida, (iii) only trunk and tail-like structures, (iv) tail-like structure only. It is argued that the processes of epiboly and invagination are interdependent in time and space in the eggs' history for normal formation of an embryo and if any agency disturbs this relationship abnormalities are created. (Auth. summ.)

3160. Swarup, H. 1959. ABNORMAL DEVELOPMENT IN THE TEMPERATURE TREATED EGGS OF *GASTEROSTEUS ACULEATUS* (L.); III. TWINNING. Journal of the Zoological Society of India, Vol. 11, No. 1, pp. 7-10.

Twins are produced when the freshly fertilized eggs of *G. aculeatus* are subjected to a temperature of 0°C. Of the three twins produced one remained undifferentiated; the other reached an advanced stage with well developed brain and eyes while the third which also reached an advanced stage was very deficient. All the three twins died before hatching.

The temperature shock probably caused the fragmentation of the presumptive areas and due to this two centres of induction were formed on the germ ring. (Auth. summ.)

3161. Watt, Kenneth E. F. 1959. STUDIES ON POPULATION PRODUCTIVITY. II. FACTORS GOVERNING PRODUCTIVITY IN A POPULATION OF SMALLMOUTH BASS. Ecological Monographs, Vol. 29, No. 4, pp. 367-392.

Methods for estimating vital parameters of a fish stock and for four mathematical models of productivity have been applied to a sport fishery for smallmouth black bass, *Micropterus dolomieu* Lacepede, in South Bay, an arm of Lake Huron.

Data used in the analysis included 5206 scale samples collected during a creel census from 1947 to 1956, inclusive, which also collected catch-effort data, lengths, weights, stomach contents and other information on individual fish. The population was trap-netted throughout the period, generally in the spring prior to the fishing season. Netted bass were tagged and fin-clipped, or just fin-clipped, and released, thus allowing mark recapture estimates to be made. Scale samples were collected from all netted bass.

Since a variety of types of data were available

for the population, it has been used as a test case to compare mathematical models for population estimation and to predict and maximize population productivity. Attempts were made to obtain Petersen and modified Petersen estimates from anglers' recaptures of marked fish, and a variety of types of methods using catch-effort and virtual population data. It developed that all types of estimates needed a variety of corrections. When these corrections were introduced, comparable estimates for numbers of six year olds extant were obtained using three different procedures.

An IBM type 650 electronic computer was used to back-calculate lengths and weights of fish at all birthdays from scale measurement data. The weights so calculated yielded unbiased estimates of mean weight for use in biomass productivity calculations. The back-calculated lengths were used to generate length distributions of total extant populations of four year olds in year *t*. Such distributions were compared with those from four year olds caught in *t* to develop gear selectivity corrections.

When four mathematical models of population productivity were applied to the population, it turned out that all of them were deficient in one or more respects. These weaknesses reflected inadequacies in the input data, which were from a small fishery, for which relatively small amounts of information collected over only a ten year period were available. Since a great deal of information was collected on this fishery relative to other freshwater fisheries, however, it means that government agencies must raise their data-collection requirements to very high levels if they intend to predict a fishery within narrow confidence intervals, or manage a fishery using field data in the models.

The conclusion was that South Bay smallmouth black bass were very much underexploited, but more data collected over an increased range of fishing intensities will be necessary to determine the fishing intensity for optimum yield under any given set of environmental conditions. Management of the resource is most productive when no legal minimum length limit is in force.

Certain general conclusions may be drawn from the first two papers in this series. Different indices of population productivity are differently affected by the same factor; independent variables in complex systems have joint, not additive interaction; forms of equations deduced from a priori considerations may be misleading, and mathematical models of population productivity should ideally be developed in terms of size and age structure of population left behind after harvest. Finally, a most important conclusion is that for given environmental conditions, productivity can only be increased by exploitation if intraspecific competition was present in the unfished population. (Auth. summ.)

3162. Swain, A., and P. E. Caradine. AN INTERNATIONAL TAGGING TEST WITH SALMON (*SALMO SALAR* L.) SMOLTS. Nature, Vol. 185, No. 4708, pp. 206-207.

The efficiency of tagging methods is being tested

by the tagging of Scottish smolts by Scottish, English, and Swedish workers and the tagging of Scandinavian smolts by English, Swedish, and Norwegian workers, each group using their own tags and methods. Statistical comparison of the methods employed should be possible in 1961 when the major part of the marked 1959 smolt crop will have been harvested.

3163. Williams, F. THE BARRACUDAS (GENUS SPHYRAENA) IN BRITISH EAST AFRICAN WATERS. The Annals & Magazine of Natural History, Vol. 2, No. 14, pp. 92-128.

East African species of Sphyraenid are taxonomically described and a key is presented.

3164. Barry, J. M., and Fergus J. O'Rourke. SPECIES SPECIFICITY OF FISH MUCUS. Nature, Vol. 184, No. 4704, p. 2039.

Attention is directed to the use of chromatographic analysis of fish mucus for distinguishing species. Closely related species may require the use of several different solvents, the examination of not only the dry but also the wet chromatogram under ultra-violet light, and the use of various location reagents. Success has been obtained in distinguishing *Gadus pollachius* and *G. virens*, and *Sebastes marinus* and *S. mentella* by mucus analysis.

3165. Kuroka, Kunio, Akio Obara, and Shogo Tanaka. 1958. STUDIES ON THE UTILIZATION OF BRACKISH LAKES. I. LIMNOLOGICAL OBSERVATIONS ON LAKE NOTORO. Bulletin of the Hokkaido Regional Fisheries Research Laboratory, Vol. 18, pp. 23-32.

Bottom water stagnation begins in summer or in autumn, resulting in oxygen deficiency and hydrogen sulfide generation in bottom zones (about 20m.). But on account of the limited area of the stagnant zones, there are no serious effects on general fishery production of this lake. Seasonal or annual variations in water quality were not marked except in these deeper zones. As for nutritional components, Lake Notooro can not be regarded as being typically eutropic, but good absorption and utilization of nutritional substances by algae ecology can be expected from the rather large dimensions of the lake and the adequate circulation of the lake water. The pollution of lake water by waste materials from starch factories was observed only in the vicinity of each factory. The polluted area disappears in spring when the lake water begins to circulate. (Auth. abst.)

3166. Ishida, Terue, and Kiichi Miyaguchi. 1958. ON THE MATURITY OF PACIFIC SALMON (ONCORHYNCHUS NERKA, O. KETA, AND O. GORBUSCHA) IN OFFSHORE, WITH REFERENCE TO THE SEASONAL VARIATION OF GONAD WEIGHT. Bulletin of the Hokkaido Regional Fisheries Research Laboratory, Vol. 18, pp. 11-22.

A great many measurements and scale samp-

ling were made on the Pacific salmon caught by mother-ship fishery in the North Pacific and Okhotsk Sea, from 1956. This report, from data obtained in 1956-57, deals with the seasonal change of gonad weight of commercial size sockeye, chum and pink salmon.

The frequency distribution of gonad weight has two peaks divided by the boundary of 20g in female and 2g in male, sharply in sockeye, and less sharply in chum, respectively. The pink salmon has a unimodal distribution like the shape of the graph of the large gonad sockeye group. The mode of small gonad group does not vary from the beginning to end of fishing season, but the large one shifts to the heavier side.

These facts lead to the supposition that the fish of small gonad group do not mature in the following fall.

In respect to age composition, body length and offshore distribution, there are differences according to whether the fish belong to the small or to the large gonad group. (Auth. abst.)

3167. Anonymous. 1960. CHEMFISH ROTENONE. Bulletin No. 2, February, Chemical Insecticide Corporation, Metuchen, New Jersey.

This bulletin covers the following topics: chem fish rotenone emulsives for fish population control, sampling, and eradication; diagnosing need for fish population control; "complete kill" - its definition, attainment, and significance; reclaiming a lake for improved fishing, choice of emulsive, concentrations to use, application instructions; population control or partial poisoning; selective killing of gizzard shad; population sampling; treatment of deep, cold bodies of water; and application equipment.

3168. Montgomery, Alex. 1959. CHEMPELS 2, 4-D FOR CONTROL OF AQUATIC VEGETATION. Bulletin No. 1, January, Chemical Insecticide Corporation, Metuchen, New Jersey.

This bulletin covers the topics; development of ChemPels 2, 4-D, types of aquatic weeds, cost of treatment, application time, rates, methods, and precautions.

3169. Feldman, Harry A., and Louise T. Miller. 1960. HEAT LABILE SERUM SYSTEMS IN FRESH-WATER FISH. Science, Vol. 131, No. 3392, pp. 35-36.

Serum specimens from 18 specimens of 12 different species of fresh-water fish were examined for their ability to kill *Toxoplasma* nonspecifically. This ability was present in all sera except those of two of three great northern pike. The effect was destroyed by exposure to 53°C, 56°C, or zymosan. Complement was demonstrated in all sera except that from one great northern pike, when rabbit erythrocytes were used in the indicator system. (Auth. abst.)

3170. Holme, N. A. A HOPPER FOR USE WHEN SIEVING BOTTOM SAMPLES AT SEA. Journal of the Marine Biological Association of the United

Kingdom, Vol. 38, No. 3, pp. 525-528.

A hopper is described which facilitates the sieving of large quantities of bottom soil at sea. It can be left unattended for short periods, and considerably reduces the labour involved in sieving. Animals are probably less damaged by this than by the usual methods, as there is considerably less disturbance in the sieve. The apparatus may be used on any ship where there is an adequate water supply to the deck, and it can be operated successfully in moderately rough weather. (Auth. summ.)

3171. Srivastava, P. N. 1960. THYROIDAL CONTROL OF RADIOPHOSPHORUS METABOLISM IN SALMON. *Nature*, Vol. 185, No. 4713, p. 621.

Radioisotopes were used to determine if the thyroid gland has any influence on mineral metabolism in fishes. Thiourea was used to destroy the thyroid gland and so to check its activity; histological studies showed that it was not achieved.

In fishes treated with thiourea the thyroid was stimulated indirectly (by thyrotropin secreted by the pituitary gland) and so uptake of radiophosphorus was more than the control. In fish treated with thyroxine the stimulation was direct and uptake of radiophosphorus maximum. Repeated doses of radioiodine achieved complete thyroidectomy.

3172. Stolk, A. 1960. LACK OF HAEMOGLOBIN IN A FISH. *Nature*, Vol. 185, No. 4713, p. 625-626.

Describes a specimen of *Cichlasoma severum*, which was less active and smaller than others of the same brood and when killed following gradual emaciation, was found to have no haemoglobin.

3173. Tucker, D. G., and V. G. Welsby. 1960. ELECTRONIC SECTOR-SCANNING ASDIC: AN IMPROVED FISH-LOCATOR AND NAVIGATIONAL INSTRUMENT. *Nature*, Vol. 185, No. 4709, pp. 277-279.

It is thought that the new electronic sector-scanning asdic has considerable possibilities in: (a) detection and location of fish; (b) identification of fish by their shoaling habits, echo-strength and shape, etc.; (c) research in fisheries work, for example, in studying the structure and internal and overall movements of fish shoals, and even of individual fish; (d) navigation; (e) hydrographic surveying. (From auth. concl.)

3174. Komarovskiy, B. 1959. THE PLANKTON OF LAKE TIBERIAS. The Bulletin of the Research Council of Israel, Vol. B8, No. 2, June, pp. 65-96.

The plankton volumes obtained by vertical haulings suggest the existence of two major seasonal pulses, one during the winter and a second during the summer months; a third, minor pulse occurs in spring, due to a heavy periodic water-bloom caused by *Peridinium westi*.

A systematic account of the main phytoplankton and zooplankton components is given. The phytoplankton was found to consist of numerous species, among which the Chlorophyceae over the Cyano-

phyceae. A special study was made of the seasonal and local variations in body shape of *Ceratium hirundinella*.

A study of the vertical distribution of plankton organisms during the stagnation period in May-June showed a fairly uniform distribution within the epilimnion down to the thermocline. No zooplankton representatives whatsoever were found in the oxygen-deficient hypolimnion, while the microscopic algae were limited to a few species occurring in low numbers.

The classification of Lake Tiberias in the light of accepted systems based on productivity is discussed. (Auth. abst.)

3175. Schoffman, Robert J. 1960. AGE AND RATE OF GROWTH OF THE WHITE CRAPPIE IN REEL-FOOT LAKE, TENNESSEE, FOR 1950 and 1959. *Journal of the Tennessee Academy of Science*, Vol. 35, No. 1, January, pp. 3-8.

The study of age and growth of white crappies in Reelfoot Lake, Tennessee, has extended over a period of twenty-one years, and during this period a change in growth rate has slowly been taking place. A decrease in the length and weight of each age-group has slowly been taking place since 1948. Between each check changes in fishing regulations have been made. Each change has reduced the number of fish caught thus increasing the population. The appearance of age-group 2 in 1959 shows the increase in population with a reduction in size and weight which has been observed by the author and dock owners, guides, commercial fishermen, resort owners, and sportsmen with whom the author discussed fishing conditions. During the summer, sportsmen are catching smaller crappies since commercial fishing of game fish was prohibited in 1955. The same was found to occur in bluegills (Schoffman, 1959). Studies should be continued to determine if the increase in population will reach such proportions that an undesirable size white crappie will appear. White crappies in Reelfoot Lake are becoming just white crappies as caught in any other body of water and not the superior white crappie with which Reelfoot has been noted. (Auth. concl.)

3176. Bennington, Elwin, and Ivan Pratt. 1960. THE LIFE HISTORY OF THE SALMON-POISONING FLUKE, *NANOPHYETUS SALMINCOLA* (CHAPIN). *The Journal of Parasitology*, Vol. 46, No. 1, February, pp. 91-99.

The major stages in the life history of *Nanophyetus salmincola* (Chapin) have been identified and described. The conflicting statements in the literature concerning biology and morphology of this fluke are discussed. All species of cercariae collected from *Oxytrema silicula* (Gould) were exposed to young salmon, with the result that the microcercous xiphidiocercariae of *N. salmincola* were found to be the only ones which penetrate fish. The fish infected were subsequently examined and metacercariae typical of *Nanophyetus salmincola* demonstrated. These metacercariae were fed to hamsters and were recovered from the intestine as adult flukes which

fit the description of Nanophyetus salmincola (Chapin). (Auth. summ.)

3177. Benson, Norman G., and John W. Parsons. 1960. FERTILIZATION OF OBED RIVER, TENNESSEE. *Journal of the Tennessee Academy of Science*, Vol. 35, No. 1, January, pp. 63-75.

Results of the work of Obed River reveal that fertilizing, where applicable, is a feasible method of fishery management. The study was not designed to experiment with improved methods or techniques or delve into the fundamentals of aquatic production; it is here that opportunity is greatest for development. Improvements in fertilizing streams will require: (1) development of methods to easily determine the nutrient requirements in any stream waters and the best fertilizer to use; (2) less laborious methods of adding fertilizer to streams, which may involve liquid fertilizers dispensed by the rate of stream flow; and (3) a better understanding of the dispersion of fertilizer nutrients downstream and its effect upon aquatic life.

The success of fertilizing warm-water streams in any area is largely dependent upon the chemical properties of the water, fish species present, the relationship between the rate of flow and displacement volume of the stream during the summer, and the general size and length of the stream.

3178. Kleerekoper, H., and G. A. van Erkel. 1960. THE OLFACTORY APPARATUS OF PETROMYZON MARINUS L. *Canadian Journal of Zoology*, Vol. 38, No. 1, pp. 209-221.

The olfactory organ of Petromyzon marinus was studied anatomically and histologically in adult and larval forms and compared with that of related cyclostomes as reported in the literature. The single olfactory organ of this species consists of three parts: the nasal tube, the olfactory sac, and a nasopharyngeal pouch. The tube is lined with indifferent epithelium and contains a valve at the entrance of the sac. The valve directs a jet stream of water into the sac when water penetrates the nasal tube. The structure of the valve allows it to reverse its position when water is expelled from the organ. The sac or nasal chamber is divided by 25 folds of its walls, 13 on the right, 12 on the left side. One of the folds, in median dorsoventral position, divides the sac into two chambers but for the anterior extremity of the sac. The folds are lined with epithelium which contains the olfactory cells. The latter are not distributed evenly in the epithelium but are limited to those areas of the folds which face a neighboring fold. The peaks and valleys of the folds are lined with indifferent epithelium. The connective tissue in the posterior and dorso-posterior regions of the sac contains clusters of cells within blood sinuses. These clusters are the accessory olfactory organ; no open communication could be found between the clusters of cells forming this organ and any other part of the olfactory organ. The organ is innervated by rami of the n. olfactorius which is formed by the sensory cells of the folds in the nasal sac. The whole is surrounded by the

cartilaginous nasal capsule. The pouch is a continuation of the nasal tube in ventral and ventro-caudal direction and lies between the digestive tract and the nasal sac and brain. Its posterior part is enlarged laterally and ends as a blind pouch at the level of the second internal gill opening. Since the pouch is not protected by rigid cartilage it is subject to the rhythmic contractions and relaxations of the respiratory muscles and body walls, thus sucking in water during the inspiration and expelling it during the expiration phase.

3179. Tait, J. S. 1960. THE FIRST FILLING OF THE SWIM BLADDER IN SALMONIDS. *Canadian Journal of Zoology*, Vol. 38, No. 1, February, pp. 179-187.

Salmo trutta, S. gairdneri, Cristivomer namaycush, and Coregonus clupeaformis failed to fill their swim bladders while being reared without access to an air surface for 84, 50, 22, and 56 weeks after hatching, respectively. When given access to an air surface they filled them. It is concluded that like other physostomes, they must swallow air for the initial filling, but even if filling is delayed their pneumatic ducts remain open. In control trout, filling occurred at the beginning of feeding, and in whitefish controls, 2 to 3 months after hatching (at 20-22 mm length). Lake trout fry with unfilled swim bladders swam up vertical distances ranging up to 900 ft. without marked fatigue, indicating that fish hatched in deep water can swim to the surface with relative ease to fill their swim bladders.

3180. Bell, Gordon R., and Jack E. Bateman. 1960. SOME RADIOGRAPHIC OBSERVATIONS ON THE GASTROINTESTINAL AND URINARY SYSTEMS OF ANESTHETIZED PACIFIC SALMON (ONCORHYNCHUS). *Canadian Journal of Zoology*, Vol. 38, No. 1, February, pp. 199-202.

Standard radiography with barium sulphate as the opaque medium was used to show the gastrointestinal and urinary systems of some intact, living Oncorhynchus species. The fish were anesthetized and the barium introduced into the systems. Views are presented in a series of photographs.

3181. Ali, M. A. 1960. THE EFFECT OF TEMPERATURE ON THE JUVENILE SOCKEYE SALMON RETINA. *Canadian Journal of Zoology*, Vol. 38, No. 1, February, pp. 169-171.

A histological study of the retina of underyearling sockeye salmon, Oncorhynchus nerka, reveals that temperature has no effect on the cones either in light or in dark. In light, the retinal pigment is not influenced by temperature, while in the dark, temperature above 15°C brings about a slight expansion.

3182. Newstead, J. D., and Peter Ford. 1960. STUDIES ON THE DEVELOPMENT OF THE KIDNEY OF THE PACIFIC PINK SALMON (ONCORHYNCHUS GORBUSCHA (WALBAUM).) III. THE DEVELOPMENT OF THE MESONEPHROS WITH PARTICULAR REFERENCE TO THE MESONEPHRIC TUBULE.

Canadian Journal of Zoology, Vol. 38, No. 1, February, pp. 1-7.

The origin and subsequent elaboration of the mesonephric tubules from condensation of cells derived from the intermediate cell mass is described from the earliest appearance of condensations to the differentiated stage in the year-old fingerling. It is noted that both the pronephric and mesonephric kidneys are present together for a considerable period of the early life of the pink salmon, though it is unlikely that both function simultaneously. (Auth. abst.)

3183. Darroch, J. N. 1959. THE MULTIPLE-RECAPTURE CENSUS. II. ESTIMATION WHEN THERE IS IMMIGRATION OR DEATH. *Biometrika*, 46 (3 and 4): 336-351.

Previous paper on multiple-recapture census when population is closed both from augmentation from outside and departure from inside. This paper removes these restrictions. "The main aims of this paper, as of (I), are to provide exact, fully stochastic models for the observed frequencies of individuals, to show how simply these frequencies naturally group themselves, and to obtain estimates of the unknown parameters. When there is immigration only or death only, the estimates are shown to be asymptotically efficient and their variances are found. In addition, a method of performing tests on the values of the parameters is given. When both immigration and death are operating, on the other hand, the complexity of the probability density prevents us from going further than obtaining the estimates and merely indicating how their variances can be found.

Both in (I) and in the present work we have been unable to obtain satisfactory tests of the underlying assumptions of the models, notably that tagged and untagged animals are captured with equal probabilities." (V.S.)

3184. Musacchia, X. J. 1959. A STUDY OF LIPIDS AND WATER OF LIVER AND MUSCLE IN *FUNDULUS HETEROCLITUS* (LINNAEUS) AND *STENOTOMUS VERSICOLOR* (MITCHILL). *Zoologica*, Vol. 44, Part 4, Dec. 31, Nos. 9 to 13, pp. 169-171.

Cholesterol, phospholipid, total fatty acid and water content of the liver and muscle of two common temperate zone fish, *Stenotomus versicolor* and *Fundulus heteroclitus*, have been determined, and the relationships of the various lipids to each other and to water content have been shown. In both species, the muscle tissue has a higher water content than the liver, while the latter has the higher lipid concentration. An inverse relationship of tissue water and lipid concentrations is demonstrated.

Evidence is presented that tends to confirm the existence of a lipocytic coefficient, i.e., that the cholesterol/total fatty acid ratio is constant in tissues from diverse species of fishes. (Auth. summ.)

3185. Breder, C. M., Jr. 1959. OBSERVATIONS ON THE SPAWNING BEHAVIOR AND EGG DEVELOP-

MENT OF *STRONGYLURA NOTATA* (POEY).

Zoologica, Vol. 44, Part 4, Dec. 31, Nos. 9-13, pp. 141-147.

The eggs of *Strongylura notata* (Poey) go through development typical of their group in a little more than two weeks, at temperatures close to those found in much of their range. Because of the places in which the eggs are spawned, it is suggested that they may be required to withstand considerable desiccation. The spawning behavior is simple and the pairs take a common side-to-side position, forming as much of an "S" shaped curve as their rather stiff bodies permit. Spawning seems to take place regularly within the tangle formed by the aerial roots of the red mangrove, a situation so sheltered that direct observation is nearly impossible. It appears that spawning always takes place on a lee shore, the least rippling of the surface serving to disperse the spawning groups. No fighting among the males has been noticed, but it would not be surprising if such was found to take place under certain conditions. (Auth. summ.)

3186. Becking, L. G. M. Baas, J. M. Thomson, and E. J. F. Wood. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE, N. S. W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. *Australian Journal of Marine and Freshwater Research*, Vol. 10, No. 3, pp. 269-270.

In the period 1883-98 Lake Macquarie was the principal source of fish for Sydney and Newcastle. Since 1930 it has been only tenth or eleventh of New South Wales estuaries in fish production. The number of commercial fishermen in 1920 was 110, but today is only 35. Allegations of depletion prompted this investigation, the results of which are discussed in this series of papers.

Lake Macquarie is a coastal lake with a small freshwater inflow estimated to be only 4 percent of its volume. Attempts to improve the channel connecting the lake with the sea have failed repeatedly. A seemingly permanent result of the dredging is a great enlargement of the unproductive sand flat at the inner end of the channel. The soils of the lake's catchment area are poor in minerals. The land vegetation is mainly sclerophyllous forest with isolated patches of rain-forest and Melaleuca swamp. (Auth. summ.)

3187. Spencer, R. S. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE, N. S. W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. II. HYDROLOGY. *Australian Journal of Marine and Freshwater Research*, Vol. 10, No. 3, pp. 279-296.

Lake MacQuarie is a marine-dominated drowned valley connected to the sea by a shallow narrow channel which damps tidal oscillations from 5 ft. on the coast outside to about 3 in. in the lake. Superimposed on the semi-diurnal tides are changes in level in response to changes both in the external daily mean sea-level and in the volume of fresh water discharge into the lake.

Temperature and chlorinity cycles are closely

linked. Discharge from the creeks supplies phosphate but little nitrate for the lake. Prolonged heavy rainfall in both 1955 and 1956 produced stratification of the water associated with lowered oxygen tension in the underlying salt water. There is evidence of a wind-generated circulation within the lake. (Auth. summ.)

3188. Becking, L. G. M. Baas. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE N. S. W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. III. CHARACTERISTICS OF WATER AND MUD. Australian Journal of Marine and Freshwater Research, Vol. 10, No. 3, pp. 297-303.

The water of Lake Macquarie is very similar to sea-water though deficient in total base.

The deep muds are of a fine silt, partly oxidized, with an E_h about +225 mV. Reduced muds (-75 mV) have been found only in semi-isolated places such as "The Hole". The mud contains only a small clay fraction and includes very little iron compared with most estuarine muds. This lack makes the bottom muds theoretically susceptible to calamitous sulphate reduction when the oxygen level of the superjacent water is lowered, as happens when stratification follows rainy periods. (Auth. summ.)

3189. Wood, E. J. F. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE, N. S. W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. IV. BACTERIAL AND FUNGAL STUDIES. Australian Journal of Marine and Freshwater Research, Vol. 10, No. 3, pp. 304-315.

Bacterial communities in Lake Macquarie show several peculiarities including the paucity of cellulose digesters and agar digesters, and the presence at times of anaerobic sulphur bacteria in waters containing considerable oxygen.

The E_h of the lake bottom is frequently positive, negative potentials being recorded from decomposing *Zostera* patches and from the microbially rather inert blue muds. The latter show little or no active sulphate reduction, though *Desulphovibrio* may be present. Photosynthesis controls the pH on the sea-grass flats, values as high as 9.7 having been recorded off Swansea flat on a sunny afternoon.

Bacterial populations are relatively low, especially in the muds, and there is no marked seasonal variation.

Contamination by faecal pollution of the lake waters could not be demonstrated, either during the summer holiday season or during a typhoid epidemic at Swansea. (Auth. summ.)

3190. Davis, P. S. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE, N. S. W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. V. CHLOROPHYLL DISTRIBUTION. Australian Journal of Marine and Freshwater Research, Vol. 10, No. 3, pp. 316-321.

The chlorophyll *a* in samples from five stations in Lake Macquarie was determined over the period

July 1955 to November 1956. The mean surface value for the four stations within the lake proper was 1.26 mg/m³. The vertical profile at one station was studied and the mean of these profile values was 1.23 mg/m³. Throughout the period of the survey chlorophyll concentrations in the lake varied from 0.1 to 4.0 mg/m³. The lowest values were found in the late winter and early summer (November) and the peaks during spring and autumn.

The chlorophyll concentration in the surface waters of Lake Macquarie was shown to be significantly higher than that of the marine water entering the lake, but lower than that of a comparison station in the Hawkesbury River.

One series of light penetration measurements made in December 1956 showed that all the water in the lake, and all but one section of Dora Creek, lay within the euphotic zone. (Auth. summ.)

3191. Wood, E. J. F. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE, N. S. W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. VI. PLANT COMMUNITIES AND THEIR SIGNIFICANCE. Australian Journal of Marine and Freshwater Research, Vol. 10, No. 3, pp. 322-340.

There are four plant communities in Lake Macquarie: the sea-grass community, the reef community, the mud bottom community, and the phytoplankton community.

Biologically, the sea-grass community is regarded as being the most important. The epiphytes on the sea-grasses are largely used as food by phytophagous fish and other animals.

The reef community consists of larger brown algae which are not of themselves of great importance and of felts of blue-green algae such as *Ectocarpus*, and other filamentous forms which are important.

Photosynthetic organisms are sparse in the mud bottoms, except for the tapetic organisms in the sea.

Phytoplankton is relatively abundant. (Auth. summ.)

3192. MacIntyre, R. J. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE, N. S. W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. VII. THE BENTHIC MACROFAUNA. Australian Journal of Marine and Freshwater Research, Vol. 10, No. 3, pp. 341-353.

The benthic zone of Lake Macquarie, passing from shallow to deep water, consists of weed, slope, and mud zones, occupying respectively 23.5, 16.0, and 60.5 per cent of the lake area. The biomasses of the invertebrate macrofauna of the zones are respectively 94 ± 56 g, 180 ± 12 g, and 10.6 ± 9.4 g per m². Each zone has its typical fauna. A variety of species occurs in the weed and slope zones, but only two species occur in number in the mud zone.

A number of mollusc species was represented only by dead shells of recent origin, suggesting some catastrophe such as production of anaerobic conditions. There is no evidence that the mussel *Trichomya hirsuta* was affected, and experimentation revealed that this species can survive long periods of

immersion under anaerobic conditions. (Auth. summ.)

3193. Thomson, J. M. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE, N.S.W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. VIII. TRENDS OF THE COMMERCIAL FISH CATCH AND MANAGEMENT OF THE FISHERY. Australian Journal of Marine and Freshwater Research, Vol. 10, No. 3, pp. 354-364.

Although the total catch has fallen since 1922 the abundance of fish as measured by the catch per man has not. The total catch has dropped because fewer men are fishing. A real drop in the abundance of certain species, namely flathead, bream, luderick, and sea mullet, occurred between 1945 and 1947; the algal-feeding luderick and mullet regained their abundance by 1951, but the three ground fish had not regained their former abundance by 1957.

The trends of the monthly catch are similar in all years, the catch expectation being least reliable in November and most predictable in February.

Closing of the northern end of the lake to commercial fishing has resulted in a loss to the consumer of quantities of sea mullet and tailor, species which are fished ineffectively by amateur anglers. During the winter months netting in the northern part of the lake, except in certain bays which form nursery grounds for the young of several species, would have no injurious effect on the stocks. (Auth. summ.)

3194. Thomson, J. M. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE, N.S.W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. IX. THE FISHES AND THEIR FOOD. Australian Journal of Marine and Freshwater Research, Vol. 10, No. 3, pp. 365-374.

During this investigation, 103 species of fish were taken in Lake Macquarie. Thirty-four are fishes of commerce, though only 12 are of local importance. There are no food records of 24 species; of the others, eight are herbivores, 13 omnivores, and 58 carnivores. In the last group are 27 microphagous and 30 macrophagous species. All but six of the macrophagous species consume fish, mostly hardyheads and gobies. Relatively few commercial species of fish were found in fish stomachs. Twelve species of planktivorous fish are distinguished. (Auth. summ.)

3195. Thomson, J. M. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE, N.S.W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. X. THE MOVEMENTS OF FISH. Australian Journal of Marine and Freshwater Research, Vol. 10, No. 3, pp. 375-387.

Of 20,128 fish of 29 species tagged, 9.4 percent were recovered by commercial fishermen and anglers. A further 1.5 percent were retaken by the tagging crew. Only 11 species were tagged in numbers greater than 100. Returns covered 17 species, showing recovery rates varying from 1 to 21 percent.

Some exchange of fish takes place between the

northern and southern parts of the lake, but this is consistent only in the case of the flat-tail mullet. Within the two parts of the lake lateral movements of some species take place; other species are sedentary. These facts suggest that the necessary condition for population estimation, that tagged fish should be randomly distributed amongst the population, is not achieved for most species. (Auth. summ.)

3196. Thomson, J. M. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE, N.S.W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. XI. ESTIMATION OF FISH POPULATIONS. Australian Journal of Marine and Freshwater Research, Vol. 10, No. 3, pp. 388-398.

Estimations of populations of six species of commercial fish were carried out by the mark-and-recapture method using modifications of the calculation methods of Petersen and Schnabel. Results from the two methods do not differ in order of magnitude except in occasional months. The estimates, however, are probably unreal, or refer to a part of the population rather than the whole, as it is doubtful whether tagged fish became randomly distributed throughout the population and migration and mortality must have continued during the period of calculation. It was possible to make an estimate of mortality rate but not of the effects of migration nor of recruitment. (Auth. summ.)

3197. Thomson, J. M. 1959. SOME ASPECTS OF THE ECOLOGY OF LAKE MACQUARIE, N.S.W., WITH REGARD TO AN ALLEGED DEPLETION OF FISH. XII. SUMMARY REVIEW. Australian Journal of Marine and Freshwater Research, Vol. 10, No. 3, pp. 399-408.

The nature of the entrance channel determines the peculiar attributes of Lake Macquarie. The food of the fish appears to be derived ultimately from the benthic flora, including epiphytes, rather than from the plankton.

In terms of the commercial fish catch per man the lake is as productive as it ever has been; amateur angling is increasing in intensity and in midsummer rivals the effects of the commercial fishermen. The fall in catch of certain species during the decade 1946 to 1955 is attributed to the reduction of food consequent upon stratification of the lake waters after prolonged periods of heavy rain. (Auth. summ.)

3198. Satomi, Yoshihiro. 1959. RELATIONSHIP BETWEEN SEASONAL CHANGE OF ANABAENA AND ENVIRONMENTAL CONDITIONS IN A FARM POND. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, No. 10, pp. 798-802.

The succession of a molecular nitrogen fixing blue-green alga, *Anabaena* was investigated in a farm pond where chemical fertilizers applied in Nagano Prefecture during the years of 1954 to 1956. The results were obtained as follows:

1) Maintenance of the algal blooming and acceleration of their growth rate were not found to be affected by the application of phosphorus fertilizer. The phenomenon was interpreted that the assimilable carbon

played possibly a role of limiting factor.

2) "Heterocyst frequency" proposed by Fogg (1953) showed the minimum value of 2 to 3% when the growth of *Anabaena* had attained the maximum, suggesting that their maximum growth might be determined by the estimation of the value of heterocyst frequency. The chemical fertilization was found to have affected more on the heterocyst formation than on the resting spore formation. It seemed reasonable to assume, therefore, that in the course of the algal growing the former plays role different from the latter.

3) In three-year period of the study *A. viguieri* was determined dominant species in the pond water especially in June. In 1956, with nearly complete control of water plant growth affected by the stocking of grass-carp, other two species of algae, *A. contorta* (in July) and *A. flos-aquae* (in August) were also detected dominant.

4) The maximum yield of *Anabaena* was suppressed by the growth of water plants in the pond water, which, however, did not affect on the growth rate of the former. (Auth. synop.)

3199. Sato, Tetsuya, and Fumio Mitani. 1959. STUDIES ON THE GROWTH AND AGE OF THE YELLOW-TAIL, *SERIOLA QUINQUERADIATA* T. and S., FOUND IN JAPAN AND THE ADJACENT REGION. II. ESTIMATION OF AGE AND GROWTH FROM THE OPERCULAR BONE. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, No. 10, pp. 803-815.

In the present work, the opercular bones are used for the age estimation of the yellowtail, *Seriola quinqueradiata* T. and S. We have found the bone to be extremely suitable to our particular requirement of analysing the growth of the fish, and in some cases the bone is preferable to scales for the purpose intended, although scales still remain most widely used for the age estimation of the fish owing to their having clear structure in their younger stages and our sampling methods from the fish body being simple.

The opercular bone has alternating bands of translucent and opaque character. These characteristic lines marked between the two bands we call operculum marks. Our successive collections of the bone all through the year have led us to believe that the operculum mark is formed every winter. But the first mark can hardly be seen in the fish larger than about 30 cm. in length owing to many keels radiating from the junction of the bone with the hyomandibular bone to the posterior. Therefore, in the case of older fish, it is necessary for us to add one more mark to the observed ones for the accurate estimation of the age of the fish. The fish attains about 29 cm. in fork length in a year; about 49 cm in two years; about 63 cm. in three years; about 73 cm. in four years; about 84 cm. in five years and about 86 cm. in six years. (Auth.)

3200. Ono, Toyoki, Fumio Nagayama, and Yasuo Mochizuki. 1959. STUDIES ON THE FAT METABOLISM OF FISH. I. CONTENTS OF FAT AND

PHOSPHORUS DURING THE GROWTH OF RAINBOW TROUT. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, No. 10, pp. 858-861.

In this experiment, the behaviors of the phosphorus and fat contents of rainbow trout, *Salmo irideus*, during its growth were observed. Fat content was reduced during the development from fertilization to hatching and began to increase after two months feeding. The following samples showed a maximum content of phosphorus in each type: (1) one month fed fry-insoluble and ether soluble phosphorus, (2) three month fed fry-water soluble phosphorus. Total phosphorus reached its maximum content in one month fed fry.

It is considered that the most parts of phosphorus, in the early stage of growth, are utilized for construction of tissues and movement of fish. (Auth.)

3201. Nose, Yukio. 1959. ON THE CONFIDENCE LIMITS CORRESPONDING TO THE ESTIMATE OBTAINED BY DELURY'S LOGARITHMIC CATCH-EFFORT METHOD. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, No. 12, pp. 953-956.

Supposing that the relationship between $\ln(C(t))$ is a simple regression, the author introduced an equation which gives the confidence limits corresponding to the estimate obtained by DeLury's logarithmic catch-effort method. The $(1-\alpha)\%$ confidence limits for N are given by the roots of the quadratic equation:

$$N^2 \left[\hat{k}^2 - t_{\alpha}^2 s^2 (c_{22} - 2\hat{k}c_{12} + \hat{k}^2 c_{11}) \right] - 2\hat{k} \cdot \hat{k}N \cdot N + \hat{k}N^2 = 0$$

where t_{α} is the value of t at the $\alpha\%$ level for $n-2$ d. f. and c_{11} , c_{12} and c_{22} are the elements of inverse matrix of the normal equations which determine k and $\ln(kN)$.

The author ascertained that the equation is available to roughly check the accuracy of estimate, by comparing the confidence limits calculated by this method with that obtained from $K(t) - C(t)$ relationship; the source of data being that of Japanese common goby, *Acanthogobius flavimanus* in the northern part of the Tokyo Bay.

3202. Lukin, A. V. 1958. MANAGEMENT OF THE FISH INDUSTRY OF THE KUIBYSHEV RESERVOIR. (RYBOKHOZIAISTVENNOE OSVOENIE KUIBYSHEV-SKOVO VODOKHRANILISHCHA.) M., Rybnoe Khoziaistvo, No. 8, August, pp. 22-24.

The Kuibyshev reservoir, created in 1956, is one of the largest in existence. It receives about 85% of the entire watershed of Kama River.

Other favorable conditions which enhance the fishing industry are: shallowness; long and hot summers; good fish composition in the tributaries; available spawning grounds for sturgeon; conservation of water level in the summer, etc. The negative side is the industrial pollution of the Kama River, causing fish poisoning in winter.

With the aim to create favorable conditions for

stocking valuable fish, the following steps were taken before the completion of the reservoir:

A two-year prohibition was established in trade of sturgeon, bream, pike perch and carp, and catches of low-valued fish were organized. Thirty-three thousand *Cyprinus carpio* breeders were introduced from the Lower Volga, about 1,000 sturgeon were transferred from the tail water, over one million *C. carpio* first-year crop were planted into the submerged zone and reared in lakes and ponds formed by the river overflow.

Spawning-rearing fisheries with pond area of 1,314 hectares will maintain the supply of valuable fish in the reservoir. But these have not yet been completed.

Attributable to the regulated river outlet and to the highly productive soils, the quantity of zooplankton has increased considerably.

Rules and regulations of catches will have to be enforced. Game and food fish catches must be prohibited during spawning periods. In places, where the young fish are kept, such prohibition should be from the time ice begins to melt to October 1.

To firmly establish favorable conditions for future growth and supply of valuable fish, pollution of the Kama and Belaya Rivers must be checked. (R. G. K.)

3203. Smith, C. Lavett. 1959. HERMAPHRODITISM IN SOME SERRANID FISHES FROM BERMUDA. Papers of the Michigan Academy of Science, Arts, and Letters, Vol. XLIV (1958 Meeting), pp. 111-119.

Within the family Serranidae three types of sexuality are known. Freshwater species (genus *Roccus*) are gonochoritic, and the only known hermaphrodites are teratological. Most species of the subfamily Serraninae are synchronously hermaphroditic, but the black sea bass of the Atlantic coast, which seems properly placed in the subfamily, has been shown to be proterogynous. All members of the Epinephelinae so far studied seem to be proterogynous, although the divergent *Paranthias furcifer*, provisionally placed in this sub-family, may be gonochoritic (Table I). Data are inconclusive for *Rypticus saponaceus* (sub-family Grammistinae), but it too may be gonochoritic.

Although some members are highly specialized, the Serraninae, in my opinion, are closest to the ancestral serranid stock. It seems most likely that proterogyny has been derived from synchronous hermaphroditism. Whether the gonochorism of the other subfamilies has likewise been secondarily derived from hermaphroditic ancestors cannot be answered at present.

It is not known what factors trigger the change from female to male, but an investigation of this problem could begin with a study of the glandular tissue lying in the region of the genital veins.

The size dimorphism between the sexes may prove of value in future management practices because the catch could, by appropriate size restrictions, be limited to either sex or to any proportion of the sexes. If it is found that a single large male

can service several females, proportionately more males can be harvested. (Auth.)

3204. Eriksen, Clyde H. 1959. A COMPARATIVE STUDY OF THE STANDING CROPS OF THE MATE-EDGE FAUNA OF THREE BOG LAKES. Papers of the Michigan Academy of Science, Arts, and Letters, Vol. XLIV (1958 Meeting), pp. 97-110.

Three bog lakes in northern, lower Michigan (near Douglas Lake), were studied for two summer months in 1956. As expected, population numbers varied with each bog, and sequential collections showed the bell-shaped curve of population growth and decline. Odonates comprised about 75 percent of the animal fauna of the mat margins; tadpoles, hemipterans, and coleopterans comprised the other significant groups.

These bogs are exceedingly more productive than previous research would lead one to believe. Production of numbers (as measured by standing crop) is correlated with conditions found. The type and physical arrangement of the mat margin, combined with the concentration of planktonic forms at mat edge, seem the most influential determinants of productivity. (Auth. summ.)

3205. Vines, R. G., and R. J. Meakins. 1959. PHASE TRANSFORMATION IN COMMERCIAL CETYL ALCOHOLS FOR WATER CONSERVATION. Australian Journal of Applied Science, Vol. 10, No. 2, pp. 190-200.

Phase transformation in two different kinds of commercial cetyl alcohol pellets has been investigated by dilatometric measurements, heating and cooling curves, and X-ray and dielectric studies. Hard, translucent pellets (of high stearyl alcohol content) transform at $\sim 34^{\circ}\text{C}$ when heated, the transition temperature being reduced to 30°C or less if the material has been heated previously. On cooling a slight transformation occurs at 31°C , the main transition being delayed to 22°C . Soft, opaque pellets (containing smaller quantities of stearyl alcohol) transform on heating at 38°C , and on cooling $\sim 32^{\circ}\text{C}$, where the reconversion is complete.

In water, the transition temperatures of both kinds of pellets are substantially reduced. When the opaque material is heated transformation now occurs at not much more than 30°C , or even lower ($25-30^{\circ}\text{C}$) if it has been heated before; on cooling, the temperature must be lowered to $\sim 15^{\circ}\text{C}$ before appreciable reconversion takes place. The influence of water on the behaviour of the translucent material is still more pronounced.

X-ray measurements show that the transitions observed are almost exclusively from sub α (low temperature form) to α (high temperature form). It appears that neither opaque nor translucent samples contain quantities of β phase material (the stable form for pure cetyl alcohol at room temperature). The main differences between the two samples seem to be connected with variations in the manner and extent of the ordering of their crystal structures; the opaque material is the more highly ordered.

The relevance of these observations to the problem

of water conservation is outlined. (Auth. summ.)

3206. Alabaster, J. S. 1959. THE EFFECT OF A SEWAGE EFFLUENT ON THE DISTRIBUTION OF DISSOLVED OXYGEN AND FISH IN A STREAM. *The Journal of Animal Ecology*, Vol. 26, No. 2, pp. 283-292.

Observations made in the Sincil Dyke indicate that fish will live in undiluted sewage effluent provided the concentration of dissolved oxygen is high. The Sincil Dyke appeared to be fishless in the region of lowest dissolved oxygen concentration. It is suggested that had the dissolved oxygen always been high during the survey of the dyke, fish would have been present throughout its length. (Auth. summ.)

3207. MacDonald, T. H. 1959. ESTIMATES OF LENGTH OF LARVAL LIFE IN THREE SPECIES OF LAMPREY FOUND IN BRITAIN. *The Journal of Animal Ecology*, Vol. 28, No. 2, pp. 293-298.

Lampetra planeri ammocoetes metamorphose after close to 5 to 6 years of larval life, those of *L. fluviatilis* after close to 6 years, those of *Petromyzon marinus* after slightly more than 5 1/2 years of larval life. The ammocoetes of *P. marinus* commence metamorphosis in the autumn and complete it by about mid-winter; those of the other two species also begin in the autumn but do not complete metamorphosis until the following spring. The ammocoetes of all three species make no increase in length during the winter months and decrease in length during the final stages of metamorphosis. (Auth. summ.)

3208. Markowski, S. 1959. THE COOLING WATER OF POWER STATIONS: A NEW FACTOR IN THE ENVIRONMENT OF MARINE AND FRESH-WATER INVERTEBRATES. *The Journal of Animal Ecology*, Vol. 28, No. 2, pp. 243-258.

A number of power stations were surveyed to see whether the cooling water system had any effect on the aquatic invertebrates found in fresh and sea water. The samples of zooplankton were collected in the intake and in the outfall waters for quantitative and qualitative investigations. Some thirty-five freshwater and sixty-two marine species were identified. No detrimental effect on the organisms found was observed. They were alive after being circulated through the condensers. No difference in fauna composition between the intake and the outfall was found from the qualitative and quantitative points of view. Freshwater forms are able to live and reproduce in the cooling ponds of the power station. The chemical and physical features of the cooling water was given. (Auth. summ.)

3209. Genina, N. V., and E. F. Martinson. 1959. THE APPLICATION OF MALACHITE GREEN IN THE ILLNESS OF PIKE ROE. (PRIMENENIE MALAKHITOVOI ZELENII PRI ZABOLEVANII IKRY SHCHUKI.) M., Rybnoe Khoziaistvo, No. 7 July, pp. 26-27.

Tests have shown that a solution of malachite green is detrimental to *Saprolegnia* but that it does not harm pike roe. During roe incubation, a solution of malachite green should be applied. The method of application is described. (R.G.K.)

3210. Lobacheva, L. L. 1959. THE CHANGE IN WATER OF THE NUTRITIVE VALUE OF ARTIFICIALLY INTRODUCED FOODS USED FOR FEEDING FISH. (IZMENENIE V VODE PITATEL'NOI TSENNOSTI ISKUSSTVENNO VNOSIMYKH KORMOV, UPOTREBLIAEMYKH DLIA KORMLENIIA RYBY.) M., Rybnoe Khoziaistvo, No. 2, May, pp. 32-37.

Losses of nutritive substances of food mixtures in water are great. The basic loss of the nutritive substances occurs during the first hour of the food in the water. In aquarium condition food mixtures lose during the first hour in water over 50% fat, 40% albumen and about 40% mineral substances. Losses of nutritive substances are higher in pond than in aquarium condition. The chemical composition and the quantitative ratio of components of food mixtures, the degree of pulverization and the preparation - all affect the speed loss of food values. Losses of nutritive substances are lower in granulated foods than in powdered foods. (R.G.K.)

3211. Abakumov, V. A. 1959. DAMAGE TO FISH SUPPLY CAUSED BY LAMPREY. (VRED, NANOSIMY MINOGAMI RYBNYM ZAPASAM.) M., Rybnoe Khoziaistvo, No. 4, April, pp. 32-33.

Pacific lamprey cause damage to humpback-salmon, reaching 60% of the catches. This mass damage is evident especially in summer but less in fall keta. These parasites have also worked havoc on migratory Far-Eastern salmon.

Baltic lamprey attack *Salmo trutta* and Atlantic salmon. Volga lamprey attack Caspian salmon. This affliction has been traced back to 1870 and 1897. Lamprey consume quantities of fish but they injure many more and these die from wounds.

Lamprey catches in the north and Far East must be carried out by means of electric submarine illumination, based on the negative reaction of lamprey to light. By this method, the entire river channel, with the exception of a small dark "corridor", is illuminated by a bright electric light. Avoiding the lighted area, lamprey withdraw to the dark corridor and into the trap set for them earlier. The dark "corridor", artificially erected in the river, should correspond with lamprey's normal habitation. Best catches are accomplished in dark moonless nights when spawning is at its maximum. (R.G.K.)

3212. Tugarina, P. IA. 1959. THE TRADE AND REPRODUCTION OF GRAYLING (*THYMALLUS*) IN THE BASIN OF THE BAIKAL LAKE AND IN THE ANGARA RIVER. (PROMYSEL I VOSPROIZVODSTVO KHARIUSA V BASSEINE OZ. BAIKAL I R. ANGARE.) M. Rybnoe Khoziaistvo, No. 2, March, pp. 22-24.

Side by side with *Coregonus*, *Thymallus* are important in the Baikal and Angara fisheries. They are caught in unlimited quantities when travelling to their spawning grounds. Reduced catches are attributed

to spring sport fishing.

The aim is to maintain annual hauls of *Thymallus* on a level of 15-20 thousand centners. This can be accomplished by: (1) strict guard to *Thymallus* spawning grounds, (2) prohibiting catches of the young, (3) developing large-scale artificial breeding of the fish of Baikal tributaries and on tributaries of the Irkutsk reservoir, (4) organizing *Thymallus* trade during winter, summer and fall, (5) create cold-water pond *Thymallus* fisheries on collective farms and in industrial sections.

Two pisciculture stations are to be constructed for *Thymallus* roe incubation, to yield 30-40 million eggs.

The construction for artificial production of *Thymallus* in the Baikal basin and Angara River will not require large financial outlay, for the period of *Thymallus* roe development is short, percentage loss is low, and its incubation does not require special room or a large staff to man it.

Under a favorable hydrological regime, within two growing seasons, *Thymallus* will reach 200-250 grams. (R. G. K.)

3213. Bilyy, M. D. (Belyy, N. D.) 1959. DEVELOPMENT OF ZANDER ROE IN A HUMID ATMOSPHERE. *Dopovidi Akademii nauk Ukrain's'koi, RSR*, No. 8, pp. 912-916.

When transporting roe, a problem always arises at which stage of development and in what conditions this may be done. The article clears up the question covering the results obtained during observations of roe which developed in a humid atmosphere instead of in water. When observing Zander roe, it was stated that the development occurs exactly as in water and that it may pass all development stages including hatching. Further, it was found that the younger the roe in development, the longer it may be kept in a humid atmosphere without danger of injury to the developing embryo. The author concludes his observations as follows: if transportation of the roe is to take no longer than 4 - 5 hours, it may be transported at any stage of development - from gastrula to the pigmented oculus. In case transportation is to last longer the roe may not be taken in the stage of pigmented oculus, since almost all of it dies within the first 20 hours, but in the stage of gastrula or embryo formation. At a proper temperature, such roe can be kept in a humid atmosphere for more than 100 hours. On the transportation of roe at the gastrula and embryo formation stage, temperature and mechanical shocks are to be taken into consideration (Nikiforov 1953). At a high temperature, the development of roe is rather rapid, which leads to a speeded up appearance of embryos. A lowering of temperature to 4-5°C does not have an injurious effect on the roe, but retards its development. Therefore, when transporting Zander roe (particularly over long distances) the temperature may be lowered by means of putting pieces of ice between the walls of the cases. On transportation of roe under water or by a truck, it is suggested to take it at the stage of eye socket formation. Considering all the results of his ob-

servation, the author, in cooperation with the Khersonskiy Rybokombinat (Kherson Fish Combine), transported roe of various fishes on production scale by an aircraft, a truck, a cutter, by a train and under water. The loss of roe during transportation did not exceed 2 - 5%. In many instances, however, there was no loss at all. When completing incubation of the conveyed roe, the loss was much higher than during transport. Sometimes it even reached 15%. The methods of transportation and completing incubation of roe are discussed by the author in his previous papers (1954 - 56, 1958). The incubation of roe at various development stages in a humid atmosphere is shown in a table. There is one table and eight Soviet references. (SOV/STEP 21-59-8-23/26)

3214. Wolf, Ken. 1959. PLASMOPTYSIS AND GELATION OF ERYTHROCYTES IN COAGULATION OF BLOOD OF FRESHWATER BONY FISHES. *Blood*, Vol. 14, No. 12, pp. 1339-1344.

When plasma-free erythrocytes of trout contacted water they imbibed rapidly and burst. The contents combined with water to form a clot-like material. This attribute was found with amphibian erythrocytes and with reptilian erythrocytes but not with erythrocytes of two mammals. The commonly reported rapid clotting of fish blood was confirmed by a series of measured clotting times. In the presence of water complete coagulation was greatly accelerated, presumably by the erythrocyte participation. Methods are described and some characteristics of the coagulum are given. Possible relationships to survival and to evolution of vertebrates are briefly discussed. (Auth. abst.)

3215. Ono, Toyoki, Jirō Senō, Fumio Nagayama, and Kazuaki Hikota. 1959. STUDIES ON THE FAT METABOLISM OF FISH. 2. HISTOLOGICAL AND CHEMICAL STUDIES ON FAT AND PHOSPHORUS IN RAINBOW TROUT. *Jour. Tokyo Univ. of Fisheries*, Vol. 45, No. 1, March 1959, pp. 79-88.

Rainbow trout were histologically and chemically studied at 12 stages during the development and growth. Yolk vanishes in appearance in 25 days after hatching, but it remains anatomically and needs about 20 days until its complete disappearance after commencement of feeding. The deposition of fat is earlier on dorsal side and later on abdominal. The loading of fat is most abundant on both sides of dorsal and ventral. Although fat is contained in large quantity in the dark muscle cells, it is richer at the cephalic portion and decreases gradually towards the tail region. Spinal cord of fishes in the stages from a larva, which is just after hatching, to a yearling is fairly rich in fat being stained in deep orange tint with alcoholic solution of Sudan III. Chemically, what metabolism will be carried on fat and phosphorus during the development and growth of rainbow trout were studied. The fat content diminished rapidly after a fertilization and then increased gradually after a start of feeding. The water soluble phosphorus was accumulated during the fertilization and indicated a maximum content in the fingerling fed for a month, but diminished again fol-

lowing to the growth of fish. The water insoluble phosphorus, however, was little accumulated at that time, but after feeding indicated a maximum about two months later than the former. (Auth. summ.)

3216. Imamura, Yutaka, and Michio Ogura. 1959. STUDY ON THE RESPONSE OF TRACHUROUS JAPONICUS TO AIR-BUBBLES. Jour. Tokyo Univ. of Fisheries, Vol. 45, No. 2, March 1959. pp. 196-203.

Angling of the Pagrosomus major is favored by the air bubble in respect of gathering fish in the following conditions, namely, as known, fine weather, the fishing ground with shallow water and clear water.

The author supposes from the present result that the effectiveness of air bubble or air curtain in chasing the herrings would attain an optimum in the following conditions, fishing ground in comparatively deep sea, a muddy water, and a relatively low illumination owing to cloudy weather. (Auth. concl.)

3217. Imamura, Yutaka, and Michio Ogura. 1959. STUDY ON THE FISH-GATHERING EFFECTS OF AIR CURTAIN. Jour. Tokyo Univ. of Fisheries, Vol. 45, No. 2, March 1959, pp. 173-177.

The data clearly indicated that the air curtain makes an effectual tool for driving the Trachurus japonicus. However, the air curtain is not possible to keep the fish for a long time in a desired place. (Auth. concl.)

3218. Imamura, Yutaka. 1959. STUDY ON THE DISPOSITION OF FISH TOWARDS LIGHT NO. 4. THE STRENGTH OF ILLUMINATION COMFORTABLE TO MACKEREL AND TRACHUROUS JAPONICUS. Jour. Tokyo Univ. of Fisheries, Vol. 45, No. 2, March 1959, pp. 185-193.

When fish are left to freely move about under an illumination falling within a range of 2.35~39.5 lux, they react to light in the following manner:

A largest crowd of fish is formed in a place of least illumination (mackerel and Trachurus japonicus).

As to their response to the illumination in the above-mentioned range of strength, mackerel and Trachurus japonicus are not far different from carp.

It seems likely that the fishes would gather in a place of an illumination lower than 2.6 lux, if there were provided anywhere in their environment such a dark place as was actually present in the illumination range of 0.1~4.100 lux which was applied in the previous experiment with carp. This situation may be emphasized of its reproducibility from the observation that mackerel and Trachurus japonicus were always found to be fond of "a" dim place. Such a dim place, however, would have to be of an illumination of little higher than zero lux, as analogized from the experiment with carp.

Some individuals of mackerel often went swiftly for a lighter place but Trachurus japonicus con-

tinued in the main to settle down in dim places for a long time. In the lighter zone mackerel swam about more actively than Trachurus japonicus. (Auth. concl.)

3219. Honma, Yoshiharu, and Kaoru Shirai. 1959. CYSTOMA FOUND IN THE LIVER OF RAINBOW TROUT, SALMO GAIARDNERII IRIDEUS GIBBONS. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, No. 12, pp. 966-970.

The remarkable and progressive "hepatic monolocular cystoadenoma" found in a four year old rainbow trout (♀) was observed and described in this paper. The fish was reared in the fish pond, the Agano River Fish Hatchery attached to the Fishery Experiment Station of Niigata Prefecture.

The coloration of the greater part of liver is milk white owing to the tumor. The liver of fish is transformed into a large empty ball, and its cystic space is filled with clear liquid. The wall of cyst consists of four layers: the fibro connective tissue, remaining liver cells, fibro connective tissue, and colloid layers, in order beginning at the outermost layer. In the interiormost layer there were some papilloma or knobs. Consequently, the present hepatic tumor has no layer of endothelium, while the marked hyperplasia of the connective tissue layer was found.

The columnar epithelium of gall-bladder was absent, however the abnormality was not recognized in the oesophagus, stomach, and spleen. (Auth. summ.)

3220. Funk, John L. 1958. RELATIVE EFFICIENCY AND SELECTIVITY OF GEAR USED IN THE STUDY OF STREAM FISH POPULATIONS. Transactions of the Twenty-third North American Wildlife Conference, 1958, pp. 236-247.

The electric seine was most effective in capturing hog suckers, black redhorse, gizzard shad, smallmouth buffalo, river carpsucker, golden redhorse, green sunfish and bluegill sunfish in these Missouri streams. Yellow bullheads and flathead catfish were captured most effectively in hoop nets. The hoop net and electric seine were about equally effective in capturing carp, channel catfish, rock bass and longear sunfish. The electric seine and drag seine were about equally effective in taking longnose gar, northern redhorse, spotted bass, smallmouth bass and freshwater drum. The electric seine was less effective than the hoop net in taking yellow bullheads and flathead catfish. The hoop net was least effective in capturing gizzard shad, hog suckers, spotted bass, longnose gar, river carpsucker, northern redhorse, smallmouth bass, and freshwater drum. The drag seine was least effective in taking yellow bullheads, green sunfish, bluegill sunfish, rock bass, smallmouth buffalo, black redhorse, golden redhorse, carp, channel catfish, flathead catfish, and longear sunfish.

Size selectivity was evident from the fact that the average weight of most species taken in the drag seine was relatively low; in the hoop net, relatively high; and with the electric seine, intermediate. Carp and

three small centrarchid species did not exhibit this phenomenon, possibly because of the restricted range of sizes available for capture. (Auth. summ.)

3221. Sanderson, Albert E., Jr. 1958. SMALLMOUTH BASS MANAGEMENT IN THE POTOMAC RIVER BASIN. Transactions of the Twenty-third North American Wildlife Conference, 1958, pp. 248-261.

Studies by electrofishing throughout the river basin in 1955 revealed that smallmouth formed approximately 8.2 per cent of the population by weight. Desirable species formed 39.9 per cent, rough fish or less desirable species, 60.1 per cent by weight. Spawning of smallmouth was determined to be successful in tributaries and the river with the spawning period during May in 1955 and 1957 and during May and early June in 1956. Growth rate and condition factor of tributary smallmouth is inferior to that of river fish. The harvest of smallmouth from a 200-acre test area supporting a standing crop of about 16 pounds per acre of 9.0-inch-plus bass was 3.2 pounds per acre in 1956 with a minimum size of 10.0 inches. In 1957 with a minimum size of 9.0 inches the harvest increased to 5.1 pounds per acre. Calculation of total mortality rate and fishing mortality for smallmouth revealed a high natural mortality of fish over nine inches which could be made available to the sportfishery with a reduced size limit and extended season. (Auth. summ.)

3222. Sindermann, Carl J. 1958. AN EPIZOOTIC IN GULF OF SAINT LAWRENCE FISHES. Transactions of the Twenty-third North American Wildlife Conference, 1958, pp. 349-360.

Extensive mortalities of sea herring and lesser mortalities of alewives and mackerel occurred over much of the Gulf of Saint Lawrence in 1954 and 1955, and smaller mortalities in 1956. Wherever examined, such mortalities were found to be associated with systemic infection by the fungus *Ichthyosporidium hoferi*, a pathogen responsible for a similar outbreak in the Gulf of Saint Lawrence in 1913-1914, and with outbreaks in the Gulf of Maine in 1930-1931 and in 1947. Dead herring could be found in 1954 and 1955 floating at the surface, dead on the bottom, and washed up on the shores of the Gulf. The nets of otter trawlers were frequently fouled with dead and decomposing herring from the bottom. Disoriented, lethargic, infected herring could be seen dying in inshore areas during the early summer, after the time when normal fish would have moved offshore following spawning. From sampling done in 1955 it was estimated that one-fourth of the mature spring-spawning herring of the western Gulf were affected during that year alone, with indications of a similar incidence in 1954.

Experimental studies have demonstrated that, depending on host susceptibility and infective dose, the disease may occur in either acute or chronic phases, rapidly terminal in the former and progressively so in the latter. This, combined with field observations of magnitude of mortalities,

with disease incidence disclosed by sampling, and with catch statistics, suggests significant herring population reduction as a result of the outbreak.

Changes in the fisheries for other commercially important species of the Gulf of Saint Lawrence, notably cod and lobster, have been related to the epizootic in herring. (Auth. summ.)

3223. Massmann, W. H., J. P. Whitcomb, and A. L. Pacheco. 1958. DISTRIBUTION AND ABUNDANCE OF GRAY WEAKFISH IN THE YORK RIVER SYSTEM, VIRGINIA. Transactions of the Twenty-third North American Wildlife Conference, 1958, pp. 361-369.

After hatching on offshore spawning grounds in spring and early summer, young weakfish move up the York River and its tributary, the Pamunkey. In July they were found in greatest numbers in the upper York, and in August were most numerous in nearby fresh waters of the Pamunkey River. A return migration took place during September, October, and November and most young weakfish had apparently left the River and Bay by December.

Weakfish one year old and older first appeared in the upper York in May, but there was no evidence that they entered the Pamunkey River at any time. Soon after entering the river most of these one-year-old fish moved back to the Bay where they remained until fall. The seaward migration was most active during September and October.

Young weakfish which ranged in fork length from 30 to 120 mm. in July were 65 to 150 mm. long in November. The length range of a single year class was so large that fishes older than yearlings could not be separated into age classes on the basis of size alone. Modal lengths progressed from 65 mm. in August to 110 mm. in November. Older fish advanced from a modal length of 165 mm. in May to about 220 mm. in October. (Auth. summ.)

3224. Sykes, James E. 1958. PROBLEMS RELATIVE TO THE ATLANTIC COAST STRIPED BASS FISHERY AND STATUS OF ITS BIOLOGICAL RESEARCH. Transactions of the Twenty-third North American Wildlife Conference, 1958, pp. 370-377.

In this presentation I have attempted to define a few of the more outstanding problems existing among the Atlantic Coast striped bass fisheries and the methods being applied toward their solution. Much time and effort have been expended by researchers for the past several years in obtaining biological data which can, in conjunction with the results of present studies, be used to develop standards for the management of the fishery. Some assumptions have been made which require further research so that their accuracy may be accepted or rejected, and new problems requiring solution are constantly being produced by man-made environmental changes. Striped bass researchers now engaged in the study of population dynamics believe that with a continued comprehensive research program they will be able to suggest measures for the most efficient utilization of the striped bass re-

resource.

After completion of the comprehensive study, the continuance of routine systematic collection of data in regard to catch, fishing effort, age, growth, and sex ratios is not only desirable, especially where there are significantly large populations, but is necessary for successful management. After management criteria have once been established, the collection of such data yields high dividends for the time and cost involved. (Auth. summ.)

3225. Hassler, William W. 1958. THE STRIPED BASS IN RELATION TO THE MULTIPLE USE OF THE ROANOKE RIVER, NORTH CAROLINA. Transactions of the Twenty-third North American Wildlife Conference, 1958, pp. 378-391.

Hydroelectric dams, municipal growth and industrial expansion have altered the volume and quality of water in the Roanoke River. A Steering Committee representing State and Federal agencies, hydroelectric operators, industry and fishermen is endeavoring to protect the striped bass fishery to adjudicate the resources of the river for multiple use. Chemical, physical and biological studies are being conducted by the various agencies involved.

The commercial striped bass fishery in North Carolina shows annual fluctuations in catch, but there is no evidence of a progressive decrease in catch over the past 70 years.

Reservoir stratification and low-level turbine intakes have resulted in a decrease in the dissolved oxygen content of water releases. A submerged weir has been constructed by a private utility company to increase the oxygen content of water releases.

The North Carolina Stream Sanitation Committee has enacted a pollution abatement plan in order to protect striped bass and to sustain additional development of the river.

Kraft-pulp mill waste imposes an oxygen demand on the river, but the toxicity of this effluent to striped bass is avoided by an efficient recovery process and dilution by receiving waters at existing flows.

The construction of hydroelectric impoundments on the Roanoke River has considerably decreased water turbidity downstream from the dams. (Auth. summ.)

3226. Tabb, Durbin. 1958. DIFFERENCES IN THE ESTUARINE ECOLOGY OF FLORIDA WATERS AND THEIR EFFECT ON POPULATIONS OF THE SPOTTED WEAKFISH, *Cynoscion nebulosus* (CUVIER AND VALENCIENNES). Transactions of the Twenty-third North American Wildlife Conference, 1958, pp. 392-401.

The following factors are believed to be of greatest importance in contributing to the abundance and success of the spotted weakfish:

1. Large areas of shallow, quiet, brackish water (bays and lagoons).
2. Absence of predators.
3. Absence of competitor species.

4. The presence of large areas of marine and brackish water grasses.

5. An abundance of grazing crustaceans and fish of suitable size to be utilized as food throughout the year.

6. A stable temperature, ranging between about 60°F. and 80°F.

7. Adequate areas adjacent to grass flats, having a depth of 10-20 feet that may be used as winter refuge for cold.

Perhaps, in addition, such hydrographic conditions as salinity, turbidity or others may have even greater influence on the species than temperature, and it is not suggested by the above analysis that the latter is necessarily the most important. No quantitative data are available on other factors, however, and it seems possible that temperature is one of the important limiting conditions for the weakfish. (Auth.)

3227. Eipper, Alfred W. 1960. MANAGING FARM PONDS FOR TROUT PRODUCTION. Cornell Extension Bulletin 1036, New York State College of Agriculture, 31 pgs.

There are over 16,000 farm ponds in New York State and new ones are being constructed at the rate of about 1,000 a year. Of the various farm pond uses, fishing is one of the most popular, and many New York farm ponds are stocked with trout. Fishing is a source of recreation for the whole family, and trout are a real table delicacy.

The purpose of this publication is to discuss:

1. Factors to consider in deciding whether or not to stock trout.
2. Design and construction features particularly valuable in trout ponds.
3. Results that can be expected from a trout pond.
4. Where and how to obtain trout for a farm pond.
5. Management practices for obtaining the most trout fishing from your pond.

Information presented here is based largely on results of ten years' work on 70 ponds in Central New York State. The recommendations given should apply to farm ponds throughout New York that have surface areas up to two acres and maximum depths from seven to fifteen feet. (Auth.)

3228. Riggs, Carl D., and Edward W. Bonn. 1959. AN ANNOTATED LIST OF THE FISHES OF LAKE TEXOMA, OKLAHOMA AND TEXAS. The Southwestern Naturalist, Vol. 4, No. 4, pp. 157-168.

During 10 years of collecting with several kinds of gear, 71 species have been collected from the main body, headwaters, tailwaters and inundated tributaries of Lake Texoma. Annotations on ecology, reproduction and abundance are included. (Auth. abst.)

3229. Bass, J. Carl, and Carl D. Riggs. 1959. AGE AND GROWTH OF THE RIVER CARPSUCKER, *Carpiodes carpio rafinesque*, OF LAKE

TEXOMA. Proc. Okla. Acad. Sci., Vol. 39, pp. 50-69.

Data for this study of the age and growth of the river carpsucker were collected during the summer of 1949 at Lake Texoma, an impoundment of the Red and Washita Rivers. Collections were made at each of eight collecting stations distributed throughout the lake in an attempt to sample different habitats. A total of 615 river carpsucker was collected; 612 in gill nets, two in a fyke net, and one in a seine. Composition of the sample collected was affected by net selectivity. Ages were determined for 604 river carpsucker by the scale method. Of the 604 fish used, 327 (54 percent) were in age-group III. The maximum age was VI. Lack of small, young fish (age-groups O and I) and large, old fish (age groups V and VI) complicated the calculation of growth. The body-scale relationship was shown to be expressed by the equation $L = -.00615 + (1.18954) S$. Average calculated total-lengths for fish of age-groups I to VI were 3.6, 6.8, 9.4, 11.9, 14.4, and 15.0 inches respectively. The average calculated total-lengths for female river carpsucker were generally slightly greater than those of males of the same age-groups. Slight differences of doubtful significance exist between the calculated lengths of fish of the same age-groups taken at five of the eight collecting stations. Lee's phenomenon was demonstrated by the calculated total-lengths, but not explained. The length-weight relationship was determined, using the formula $W = CL^n$. Condition factors, C(TL), were determined for the sample of river carpsucker. The mean factor was shown to be 45.3; the range, 39.2 to 52.4. The usual increase in coefficient of condition with age and size was not evident. (Auth. summ.)

3230. Riggs, Carl D., and George A. Moore. 1958. THE OCCURRENCE OF SIGNALOSA PETENENIS IN LAKE TEXOMA. Proc. Okla. Acad. Sci., Vol. 38, pp. 64-67.

The first recognized specimen taken from Lake Texoma was caught in a gill net on July 4, 1957, and was easily identified by the yellow in the fins and the projecting lower jaw. Later this same day more than 50 were taken in a six by four-foot minnow seine. Collections made with seines and rotenone throughout June, July, and early August included thousands of threadfin. After it became evident that the species was so abundant, collections made in 1956 and earlier in 1957 were re-examined. No Signalosa was found in the 1956 collections, but a collection which included 395 clupeids taken from the Hickory Creek arm of Lake Texoma on June 14, 1957, contained 51 yearling Signalosa and 344 gizzard shad, Dorosoma cepedianum. The source of this population is not definitely known, but three methods of entry are credible, and any one or all of them could be involved.

1. Since the level of Lake Texoma reached an unprecedented height (643 feet above sea level) during May and June, 1957, and water flowed over the spillway at a depth of three feet, it is quite possible that a large number of adult threadfin

were able to swim up over the spillway into the lake.

2. It is also quite possible that the Lake Texoma threadfin population came from escapees from the U. S. Fish Cultural Station near Tishomingo, Oklahoma.

3. In November, 1954, about 2000 of the threadfin propagated at the Tishomingo hatchery were introduced into Mountain Lake, a small impoundment on a tributary of the Washita River, Carter County. (Auth.)

3231. Morgan, Alfred R., and Kenneth A. Henry. 1959. THE 1955-1956 SILVER SALMON RUN INTO THE TENMILE LAKES SYSTEM. Fish Commission of Oregon, Research Briefs, Vol. 7, No. 1, pp. 57-77.

In order to determine the magnitude of the run of silver salmon (Oncorhynchus kisutch) into the Tenmile Lakes system in southern Oregon in 1955-56, a tagging program was carried out by the Oregon Fish Commission. The fish were captured during their upstream migration in two types of gear, a cotton-web trap and three wire-mesh circular fyke nets. A total of 1,680 silver salmon was tagged including 805 "jacks" or precocious males. Tagged fish were recovered in the sport fishery and by surveying spawning areas in the tributaries of the lakes.

During the spawning ground surveys 12,092 dead adult silvers and 4,214 dead jack silvers were examined for tags, and 346 tags were recovered--250 from adults and 96 from jacks. The rates of capture and the rates of recovery were different for adults and jacks, and separate population estimates were made. Based on various estimates the run of silver salmon into the Tenmile Lakes system in 1955-56 was approximately 36,000 jacks and 41,500 adults. The spawning potential for this run was estimated to be about 62,400,000 eggs. The condition of the watershed in regard to changes observed from logging and farming practices was discussed briefly. In general, past and current logging and farming practices have reduced spawning and rearing areas available for silver salmon in the Tenmile Lakes system. (Auth. abst.)

3232. Hublou, Wallace F., Joe Wallis, Thomas B. McKee. 1959. DEVELOPMENT OF THE OREGON PELLET DIET. Fish Commission of Oregon, Research Briefs, Vol. 7, No. 1, pp. 28-56.

Oregon soft pellets, composed of dry meals and fresh frozen fish products or beef liver, were fed to chinook (Oncorhynchus tshawytscha), silver (O. kisutch), and blueback salmon (O. nerka) during the course of nine feeding experiments. A comparison of food conversion and cost to produce a pound of fish showed that Oregon pellets are more efficient and economical to feed than existing hatchery diets of meat and fish products. Fish produced by the Oregon pellets were generally in good health, although problems of food rancidity, sporadic fish kills, and anemia were encountered. The cause of each is being studied. Recoveries of fish fin-marked at the termination of most of the feeding trials are still incomplete. However, in two trials for which recoveries are complete,

fish fed the Oregon pellets were recovered in numbers at least as great as those fed the regular hatchery diets. Evidence was presented which indicated that the use of Oregon pellets may reduce the incidence of disease known to be propagated by feeding raw salmon products. (Auth. abst.)

3233. Burt, Wayne V., and W. Bruce McAlister. 1959. RECENT STUDIES IN THE HYDROGRAPHY OF OREGON ESTUARIES. Fish Commission of Oregon, Research Briefs, Vol. 7, No. 1, pp. 14-27.

A center for hydrographic study of Oregon estuarine waters has been established at Oregon State College. This paper summarizes the present knowledge of Oregon coastal estuaries. Oregon estuaries fall into one of three types: Type A, a two-layered or stratified estuary; Type B, partly mixed; and Type D, vertically homogenous or well mixed. An estuary may change from one type to another during the year as currents and salinity distributions change. None of the Oregon estuaries have sufficiently low tides, great depth, or high runoff to maintain a two-layered system throughout the year; salt wedges are usually poorly defined. The partly-mixed system is common in Oregon estuaries; it changes under the influence of high tides, low runoff, and shallow, wide topography to a well-mixed or vertically-homogenous type. Several Oregon estuaries become vertically homogenous during late summer. Oregon estuaries become vertically homogenous during late summer. Oregon estuaries are classified by month on the basis of salinity changes from top to bottom. Several pollution and engineering problems are pointed out. A theoretical distribution of pollutant in the Yaquina River estuary at several hypothetical outfalls is given. No matter where an outfall is located, some of the material will mix back upstream through most of the estuary. (J. V. H.)

3234. Merrell, Theodore R. 1959. GULL FOOD HABITS ON THE COLUMBIA RIVER. Fish Commission of Oregon, Research Briefs, Vol. 7, No. 1, pg. 82.

On May 11 and 12, 1955, 27 California gulls, 11 ringbill gulls, 2 immature western gulls, and 1 Forster's tern were collected below McNary Dam on the Columbia River for stomach examination. The chief item of diet was lampreys from 2 to 8 inches in length; there were 101 ammocetes of the Pacific lamprey (*Entosphenus tridentatus*), 57 adult brook lampreys (*Lampetra planeri*), 3 bream (*Richardsonius balteatus*), 1 carp (*Cyprinus carpio*), 1 stickleback (species unknown), and 5 salmonids. Additional stomach items were insects, a crayfish claw, garbage, sand, and small rocks. Lampreys comprised 71 per cent of the total volume of food. It has been assumed that the gulls were feeding on downstream-migrating salmon and steelhead trout fingerlings, but for this particular time and place lampreys were the chief food items. It is realized that there is a possibility that the birds may have regurgitated any recently-eaten food. (J. V. H.)

3235. Ross, Robert D., and Benjamin D. Perkins. 1959. DRAINAGE, EVOLUTION AND DISTRIBUTION PROBLEMS OF THE FISHES OF THE NEW (UPPER KANAWHA) RIVER SYSTEM IN VIRGINIA. PART III. RECORDS OF FISHES OF THE NEW RIVER. Virginia Agricultural Experiment Station, Virginia Polytechnic Institute, Technical Bulletin 145, 35 pgs.

The physiography, hydrography, and ecology of the New River system in Virginia are briefly reviewed, and records of fishes from the important game fish streams of this drainage are listed. (Auth. abst.)

3236. Ross, Robert D. 1959. DRAINAGE, EVOLUTION AND DISTRIBUTION PROBLEMS OF THE FISHES OF THE NEW (UPPER KANAWHA) RIVER SYSTEM IN VIRGINIA. PART IV. KEY TO THE IDENTIFICATION OF FISHES. Virginia Agricultural Experiment Station, Virginia Polytechnic Institute, Technical Bulletin 146, 27 pgs.

A list of fishes of the New-Kanawha River in North Carolina, Virginia, and West Virginia and a key to their identification are presented. Fishes known to occur within this drainage, both native and introduced, together with others reported from or expected to occur, are included. (Auth. abst.)

3237. Davis, James, and Lloyd Posey, Jr. 1959. RELATIVE SELECTIVITY OF FRESHWATER COMMERCIAL FISHING DEVICES USED IN LOUISIANA. Report by Louisiana Wild Life and Fisheries Commission, Fisheries Section, 27 pgs.

Trammel nets proved to be the most efficient in terms of pounds per net day. Selectivity of trammel nets was indicated in the catches of nets over 2.5-inch-mesh. Commercial fish comprised almost the entire catch in mesh sizes 3 inches or larger. Nylon was found to be superior to cotton or linen in gill or trammel nets. Catches in the former varied from two to four times those taken in the latter two twine types. As mesh size increases the catch per net day in most nets decreases. This is due to the escapement of smaller fishes and the fewer numbers of larger fish available. Fish caught in nylon nets were of greater average length than either cotton or linen. Within limits, as twine size increases the catch per net day decreases for trammel and gill nets. Catches in 1.5-inch-mesh cotton gill nets were higher than those in 1-inch-mesh. This apparently was due to the "dark curtain" effect of the smaller mesh net. For hoop nets mesh size is the only effective variable. Nylon does hold larger fish than cotton. Wire traps are very effective in the capture of sport fishes. Apparently they do not exceed the catch of 1-inch-mesh hoop nets to any great extent. Basket traps catch primarily catfish with little effect on other species. This device can well be put to use. (From auth. concl.)

3238. Davis, James, and Lloyd Posey, Jr. SUPPLEMENT TO RELATIVE SELECTIVITY OF FRESHWATER COMMERCIAL FISHING DEVICES USED IN LOUISIANA. Report by Louisiana Wild

Life and Fisheries Commission, Fisheries Section, 144 pgs.

The data herein presented are discussed in the parent paper. This is intended to furnish interested persons with the actual results of netting. In addition chi-square and t values are presented. A net day for trammel and gill nets was 100 yards of net, eight feet deep, fished for 24 hours. One net day for hoop nets, wire traps, and basket traps was a net fished for 24 hours. No nets were baited during the study. (Auth.)

3239. Raney, Edward C. 1957. NATURAL HYBRIDS BETWEEN TWO SPECIES OF PICKEREL (ESOX) IN STEARNS POND, MASSACHUSETTS. The Commonwealth of Massachusetts, Supplement to Fisheries Report for Some Central, Eastern, and Western Massachusetts Lakes, Ponds, and Reservoirs, 1951-52, 15 pgs.

The pickerel were collected from Stearns Pond, a 41 acre artificial impoundment constructed in 1936 at North Andover, Essex County, Massachusetts, when it was drained on November 28, 1951. The pickerel were sorted into series which represented the two species, hybrids between the two, and backcrosses to each of the parents, by using color and other characters, such as snout length, head width at occiput, head length, and body length. When the several counts and measurements were tabulated the structural intermediacy of these characters confirmed the hybrid origin of specimens first indicated as such by color classification. Besides differences in color the best way to separate the chain pickerel from the redfin pickerel is by proportional body measurements. The fin (caudal excepted) and branchiostegal rays were counted in the redfin pickerel, hybrids and backcrosses, and in an adequate sample of chain pickerel. The numbers are high for anal, dorsal, pelvic, and branchiostegals and low for pectoral rays in the chain pickerel. In all cases those specimens interpreted as hybrids are intermediate in value and in all but one case, and here the values were close, the back crosses were intermediate between hybrid and the parent species. Of the single characters mentioned here the branchiostegals rays give the best separation between the two species. No gross differences could be found in the size of the gonads or of the developing ova in the two species, the hybrids and the backcrosses. The apparent relative scarcity of the redfin pickerel in Massachusetts ponds makes it less of a problem than it is many places. Several possible management policies are considered for situations where both these species occur together. (Auth.)

3240. Cross, Frank B., James E. Deacon, and Claud M. Ward. 1959. GROWTH DATA ON SPORT FISHES IN TWELVE LAKES IN KANSAS. Transactions of the Kansas Academy of Science, Vol. 62, No. 2, pp. 162-164.

This paper presents data on the growth-rates of nine kinds of game fish collected from 1952 to 1956 inclusive from twelve of the more important

lakes in Kansas: Crawford County State Lake number 2 (= Farlington); Gardner Lake, Johnson County; Lone Star Lake, Douglas County; Prairie Lake, Jackson County; Leavenworth County State Lake (= Tonganoxie); Lake Wabaunsee, Wabaunsee County; Wyandotte County Lake; Herington Lake, Dickinson County; Nemaha County State Lake; Ottawa County State Lake; Cedar Bluff Reservoir, Trego County; and Kanopolis Reservoir, Ellsworth County. (Auth. abst.)

3241. Snow, Howard, Arthur Ensign, and John Klingbiel. 1960. THE BLUEGILL, ITS LIFE HISTORY, ECOLOGY AND MANAGEMENT. Wisconsin Conservation Department, Publication 230, 16 pgs.

Subjects covered are classification, distribution, description, habits and habitat, reproduction, growth, populations and harvest, ecology, angling, value and management.

3242. Anonymous. 1958. SALUTE TO THE SOCKEYE. International Pacific Salmon Fisheries Commission publication, 22 pgs.

This publication discusses the Sockeye of the Fraser, the Salmon Commission, races of Sockeye, identification of races, the Adams River run, rebuilding a destroyed salmon run, the catch, the long migration, spawning of Sockeye salmon and development from egg to smolt.

3243. Fischler, Kenneth J. 1959. CONTRIBUTIONS OF HUDSON AND CONNECTICUT RIVERS TO NEW YORK-NEW JERSEY SHAD CATCH OF 1956. Fishery Bulletin 163 from Fishery Bulletin of the Fish and Wildlife Service, Vol. 60, pp. 161-174.

Data for five meristic characters from shad sampled in 1956 in the Hudson and Connecticut Rivers were found to be representative of each shad population. These data were used to derive a calculated discriminant function which correctly classified 71.6 percent of a mixed sample of Hudson and Connecticut River shad. The percentage correctly classified were increased when the fish in the region of greatest overlap in meristic counts were not classified. Using this procedure, 79.7 percent of the fish were correctly classified and 20.3 percent were incorrectly classified.

The calculated function was applied to meristic data obtained from samples of shad taken on the New York-New Jersey coast. The proportion of shad landed on the coast classified as Hudson River or Connecticut River shad was 77 percent and 23 percent, respectively. Correcting these data for the 20.3 percent error in classification, the distribution of the 1956 coastal catch was estimated to be 90 percent Hudson River shad to 10 percent Connecticut River shad. The presence of shad in the coastal samples native to areas other than the Hudson or Connecticut Rivers was considered to be negligible. The results obtained in the meristic study compared favorably with those obtained from a tagging study which was conducted concurrently with this investigation. (Auth. abst.)

3244. Powers, Charles F., David L. Jones, and John C. Ayers. 1959. SOURCES OF HYDROGRAPHIC AND METEOROLOGICAL DATA ON THE GREAT LAKES. United States Fish and Wildlife Service Special Scientific Report--Fisheries No. 314, 183 pgs.

The entire Great Lakes drainage basin was reviewed for sources of hydrographic and meteorological data, potentially applicable to studies of Great Lakes hydrography and fisheries. Agencies which were found to obtain either or both of these types of data were: water treatment plants; power plants; industrial concerns; U. S. Coast Guard; paper mills; Sanitary District Observers; U. S. Weather Bureau First Order, Second Order and Cooperative stations; Canadian Meteorological Division Class I, II, III, and c stations; U. S. Lake Survey; Canadian Hydrographic Service; U. S. Geological Survey; Canadian Department of Northern Affairs and National Resources, Water Resources Branch; independent research installations; and several miscellaneous uncategorized agencies. (From auth. summ.)

3245. Rupp, Robert S. 1959. VARIATION IN THE LIFE HISTORY OF THE AMERICAN SMELT IN INLAND WATERS OF MAINE. Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 241-252.

A survey conducted by Wardens of the Department of Inland Fisheries and Game provided information on the time and duration of smelt spawning runs in 114 Maine lakes in 1958, and in two lakes in years prior to 1958. Other phases of the Maine smelt investigation provided information on spawning sites, habitats occupied, maximum sizes, and behavior with respect to angling. Large variations in these aspects of the life history of the smelt were found.

Evidence is presented which suggests that certain phases of the spawning behavior are subject to the law of heterogeneous stimulus summation. Possible reasons for the different habitat types occupied, the different maximum sizes attained, and the differences in behavior with respect to angling are briefly discussed. It is suggested that these variations might be the result of speciation in progress. If so, the genetic constitution of the various smelt populations might have implications in management. (Auth. abst.)

3246. Roos, John F. 1959. FEEDING HABITS OF THE DOLLY VARDEN, *SALVELINUS MALMA* (WALBAUM), AT CHIGNIK, ALASKA. Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 253-260.

Stomach contents of 5,050 Dolly Varden were examined during the summers of 1955 and 1956 to determine the extent of predation by this species upon young sockeye (red) salmon (*Oncorhynchus nerka*). Of 5,050 stomachs examined, 2,667 (52.8 percent) were empty. Of those containing food, 73.2 percent contained insects, and 9.0 percent sockeye salmon. In all, the 214 Dolly Varden which

had been feeding on young sockeye had consumed 649 salmon for an average of 0.1 sockeye for all Dolly Varden examined.

Predation was greatest in rapid water immediately below the outlet of Chignik Lake and here 31.1 percent of the Dolly Varden stomachs contained sockeyes. Greatest predation occurs where swift current and natural obstacles restricted movement of young salmon. Dolly Varden of intermediate size (between 15 and 35 centimeters) were the most destructive to young sockeye salmon. There was a direct relationship between size of trout and proportion with food; small fish more often had food in their stomachs. It appears that Dolly Varden feed more actively during their summer stay in salt water than during their winter residence in the lakes. It seems unlikely that the Dolly Varden is a serious predator upon the salmon in the Chignik Lake drainage. (Auth. abst.)

3247. Larimore, R. Weldon, William F. Childers, and Carlton Heckrotte. 1959. DESTRUCTION AND RE-ESTABLISHMENT OF STREAM FISH AND INVERTEBRATES AFFECTED BY DROUGHT. Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 261-285.

In 1953 and 1954 a severe drought virtually destroyed the fish and invertebrate populations in Smiths Branch, a small warm-water stream in Vermillion County, Illinois, and presented an opportunity to study the adaptations, survival, and repopulation of aquatic organisms exposed to the critical conditions associated with low water levels.

The fish population in Smiths Branch was first studied in 1951. In the fall of 1953, the flow was discontinuous, most of the pools dried up, and the few remaining pools were treated with rotenone to eliminate the surviving fish. After that time, the fish population was studied through the use of an electric seine, minnow seine, rotenone, and night observation. The invertebrate population was studied in a series of bottom samples.

Discontinuous flow reduced the aquatic habitat and exposed the fish and invertebrates to desiccation, stagnation, and predation. Stagnation was most detrimental during early fall months, in association with leaf accumulations and drastic temperature fluctuations, or during the winter when ice covered the pools. Most of the fishes withstood the extreme drought conditions in at least a few parts of the stream.

Re-establishment of the populations began as soon as the stream resumed its flow. The upstream ingress of fish was limited to the first few pools above the stream mouth until the full flow was resumed, and then, during the following 2 weeks, 21 of the 29 regularly occurring species moved into most of the stream course.

Twenty-five of the regular species of fish had entered Smiths Branch by the end of the first summer after the population was destroyed in 1953. Only three species were significantly absent: The longear sunfish was not taken until the fall of 1955, and the blackstripe topminnow and hornyhead chub had not repopulated the stream when the final collections

were made in September, 1957.

Most of the adult fish that entered Smiths Branch after the resumption of flow in 1954 reproduced successfully soon after entering the stream, so that young-of-the-year fish dominated the new population. The adults of some species apparently left the stream after spawning.

Fish moved over very shallow riffle areas during two brief periods of slight flow which occurred during a time that the stream was generally discontinuous.

Invertebrates displayed remarkable adaptations to drought conditions and repopulated Smiths Branch soon after the flow was resumed. The insects that were at first most abundant apparently were from adults that had flown in from other streams. The invertebrate population became re-established soon enough to serve adequately as food for ingressing fish.

The versatility of the stream organisms, adaptations and movements associated with environment and life cycles may account for the rapid recovery of aquatic populations in Smiths Branch. (Auth. abst.)

3248. Stoeckeler, Joseph H., and Glenn J. Voskuil. 1959. WATER TEMPERATURE REDUCTION IN SHORTENED SPRING CHANNELS OF SOUTHWESTERN WISCONSIN TROUT STREAMS. Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 286-288.

Late afternoon summer water temperatures at the mouth of a spring channel on a trout stream near LaCrosse in southwestern Wisconsin were reduced by 10° to 11° F. by shortening the channel by 67 percent and routing the water through a willow-shaded location. (Auth. abst.)

3249. Snieszko, S. F., Ken Wolf, Jimmy E. Camper, and Lyle L. Pettijohn. 1959. INFECTIOUS NATURE OF PANCREATIC NECROSIS. Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 289-293.

To determine if pancreatic necrosis is a communicable disease of trout, lots of eyed brook trout eggs were obtained from four hatcheries. Pancreatic necrosis appeared spontaneously in trout from one of these hatcheries and the other strains were exposed to infection by suspension prepared from diseased fish. In all cases, typical pancreatic necrosis appeared in fish exposed to infection and the control fish remained healthy. Disease was more acute in fry fed brine shrimp nauplii than in those fed beef liver. Mortality data suggest that susceptibility to pancreatic necrosis decreases with the increased age of trout. No treatment for the disease is known, but sanitary measures were effective in preventing its spread. (Auth. abst.)

3250. Sawyer, Philip J. 1959. EFFECTS OF CERTAIN CHEMICALS ON MUCUS-PRODUCING CELLS OF *PETROMYZON MARINUS*. Transactions of the American Fisheries Society, Vol. 88,

No. 4, pp. 305-309.

Tissue samples that contained slime-secreting cells were taken from the gills and epidermis of larval lampreys that had been poisoned by several compounds. Histochemical treatment of these pathological tissues helped delineate the fate of these mucus-producing areas of the ammocetes. It was shown that the slime-secreting cells, located at the tips of the gill filaments, lining the gill chamber, and scattered throughout the epidermis reacted differently to the same toxicant. The secretory cells of the gills were, without exception, the most sensitive to chemical attack. (Auth. abst.)

3251. Allen, George H. 1959. GROWTH OF MARKED SILVER SALMON (*ONCORHYNCHUS KISUTCH*) OF THE 1950 BROOD IN PUGET SOUND. Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 310-318.

Silver salmon (*Oncorhynchus kisutch*) of two different stocks were marked by excision of fins and released during the spring of 1952 into Minter Creek and Lake Washington drainages of Puget Sound, Washington. Over 800 of the marked salmon were recovered during 1952 and 1953 from the sport and commercial fisheries of Puget Sound, the Pacific Ocean, and closely adjoining waters. Mature adults returning to spawn were recovered at traps and weirs at the hatcheries where they were originally released. The growth over the entire 3-year life cycle of the salmon released into the Lake Washington drainage when plotted graphically showed variation in length at maturity from less than 40 to over 80 centimeters in fork length. Salmon from the Lake Washington drainage taken in salt water at the same time and place were larger than salmon from Minter Creek. The average relative lengths of salmon from Minter Creek and Lake Washington recovered in the Pacific Ocean were the same as recorded for the mature salmon recovered at the hatcheries. Salmon migrating to different areas in salt water attained different average lengths at maturity. The average lengths of marked salmon recovered from the Pacific Ocean were always larger than fish recovered at the same time from Puget Sound, and salmon of intermediate size were taken in the Strait of Juan de Fuca and in the Pacific Ocean immediately adjacent. Difference in average size between the Lake Washington salmon (Green River, Soos Creek, stock) and Minter Creek salmon is considered to be a racial characteristic. Exact reasons for differences in length attained by the salmon taken from different areas are not known. (Auth. abst.)

3252. Davis, William S. 1959. FIELD TESTS OF PETERSEN, STREAMER, AND SPAGHETTI TAGS ON STRIPED BASS, *ROCCUS SAXATILIS* (WALBAUM). Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 319-329.

Tagging experiments were conducted in north-eastern North Carolina during 1955 and 1956 to select a tag suitable for use in brackish waters for studying population dynamics and movements of striped bass. The following tag comparisons were

carried out: streamer and Petersen, streamer and soft spaggetti, and streamer and hard spaghetti. Observations were made on recovery of tags as related to size of fish, length of time tagged, selectivity of tagged fish by commercial gear, and durability of tags. The streamer tag was selected from those tested as the one best suited for future use. (Auth. abst.)

3253. Grice, Frank. 1959. ELASTICITY OF GROWTH OF YELLOW PERCH, CHAIN PICKEREL, AND LARGEMOUTH BASS IN SOME RECLAIMED MASSACHUSETTS WATERS. Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 332-335.

To evaluate the Massachusetts warm-water pond and lake reclamation program, which began in 1952, age and growth studies were made on several species of fish. After reclamation by rotenone, growth rates of yellow perch, chain pickerel, and largemouth bass were found to be more rapid than under natural conditions and in some cases growth rates exceeded those recorded in the literature. Adult fish stocked after reclamation showed marked increase in growth, as did resident adult fish remaining after thinning of the population. Rapid growth in reclaimed waters is attributed to reduced competition for food because of lower population densities. In these ponds it appears that the rate of growth of yellow perch, chain pickerel, and largemouth bass was more dependent upon population density than upon length of growing season or other factors. (Auth. abst.)

3254. Tharratt, Robert C. 1959. FOOD OF YELLOW PERCH, *PERCA FLAVESCENS* (MITCHILL) IN SAGINAW BAY, LAKE HURON. Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 330-331.

In Saginaw Bay, Lake Huron, an abundant population of yellow perch has provided a substantial commercial fishery. The commercial catch of this species averaged nearly 400,000 pounds for the years 1950-1955. Due to its importance, the Fish and Wildlife Service and other agencies have been investigating various aspects of the biology of the yellow perch in Saginaw Bay and elsewhere in the Great Lakes. This paper is a summary of a study of the food habits of this species in Saginaw Bay, Lake Huron. (Auth. abst.)

3255. McCann, James A. 1959. LIFE HISTORY STUDIES OF THE SPOTTAIL SHINER OF CLEAR LAKE, IOWA, WITH PARTICULAR REFERENCE TO SOME SAMPLING PROBLEMS. Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 336-343.

Collections of spottail shiners, *Notropis hudsonius*, were made by systematic seining in Clear Lake from 1956 to 1958. Spottails made up 4.7 and 8.5 percent of the total number of fish caught in minnow seine hauls during the summers of 1956 and 1957 respectively. For this reason, it is believed that the spottail shiner is not of major

importance as a forage fish in Clear Lake. Young of the year comprised 80, 47, and 74 percent of the spottail catch in 1956, 1957, and 1958 respectively. Growth was determined from length frequency and from scale analysis. Scales were formed when the spottails were 18 to 20 millimeters in total length. The body-scale relationship had an intercept of 14 millimeters.

Average daily growth increments of young-of-the-year spottails in the summers of 1956, 1957 and 1958 were 0.52, 0.69 and 0.65 millimeters per day respectively. Higher temperatures were related to faster growth. The growth rate of minnows of the 1956 year class from October, 1956 to June, 1957 was 0.022 millimeters per day and during the second summer was 0.18 millimeters per day. Weighted mean lengths of the spottails at the formation of their first, second, and third annuli, were 76.9, 98.2 and 107.9 millimeters respectively. A sub-sampling scheme was used in the growth analysis.

The spottails were collected more frequently at locations where moderate amounts of emergent and submergent vegetation were found. Spottails fed on a variety of materials which included water mites, Diptera larvae and adults, Tricoptera larvae, Cladocera, grass seeds and plant fibers. A moderate infection of black grub (*Neascus nolli* and a diplostomum type) was found in only one sample of spottails. (Auth. abst.)

3256. Minckley, W. L., and James E. Deacon. 1959. BIOLOGY OF THE FLATHEAD CATFISH IN KANSAS. Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 344-355.

Flathead catfish (*Pylodictis olivaris*) were collected from the Big Blue River, a highly turbid stream, and the Neosho River, a relatively clear stream, in Kansas, mostly by A. C. electric fishing gear. Flathead catfish comprised 15.1 percent of the number of fish taken from the Big Blue, and 10.5 percent of those from the Neosho. Individuals less than 4.0 inches long (total length) were found in riffles; those 4.0 to 12.0 inches long were generally dispersed in the stream; those 12.0 to 16.0 inches long were associated with cover (logs, brush-piles and rocks) in intermediate depths; and those longer than 16.0 inches were solitary, near large cover (especially logs and down trees) in deeper pools. Examination of 258 stomachs, 69 of which were empty, showed that food of flathead catfish 4.0 inches and shorter was nearly all insect larvae; that of fish 4.0 to 10.0 inches, insect larvae, fishes and crayfish; and that of larger flathead catfish mostly fish and crayfish. Kinds of food eaten evidently depended on its availability.

Young-of-the-year fish were 2.8 inches long in August in the Big Blue River, and 2.7 inches in the Neosho. Later growth in the Big Blue was faster than in the Neosho and five-year-old fish from these two streams had average total lengths of 24.8 and 17.0 inches, respectively. Length-weight relationship is presented. Male catfish in these streams become sexually mature at 15 to 18 inches long (3 to 5 years) and females matured at 18 to 20 inches (4 to 6 years). Sex ratio was approximately 1:1. Spawning occurred

from late June to late July, and 6,900 to 11,300 eggs were found in females 21.0 to 24.0 inches long. The cestode, *Marsipometra*, was a common parasite in the duodenum and nematodes occurred occasionally in the mindgut. (Auth. abst.)

3257. Helm, William T. 1959. A SIMPLE METHOD FOR INCREASING CONTRAST IN SCALE READING. Transactions of the American Fisheries Society, Vol. 88, No. 4, pg. 356.

The method described here utilizes equipment usually available in most laboratories. It provides high contrast between circuli and the grooves between them, thereby tending to make the individual circuli stand out sharply. (Auth.)

3258. Wise, John P., and Albert C. Jensen. 1959. MOVEMENT OF TAGGED HALIBUT OFF NEW ENGLAND. Transactions of the American Fisheries Society, Vol. 88, No. 4, pp. 357-358.

We have been able to tag and release 190 halibut. They were captured by Bureau of Commercial Fisheries research vessels primarily engaged in tagging trips for other groundfish species in and around the New England area. Seventeen marked halibut have been recaptured. Most of them had not travelled far from the tagging areas. Two halibut, however, travelled greater distances from where they were tagged. Both of these fish were well above the average size (about 50 centimeters) of the series of fish tagged. Martin and McCracken's observations that halibut do not cross deep-water channels in their travels are not borne out because both of the large halibut crossed the Fundian Channel which is deeper than 100 fathoms. Lea tags were used on only about 7 percent of the fish but they accounted for nearly a quarter of the returns--a difference in proportion of return more than three-fold that of the Petersen tags. (Auth.)

3259. Anonymous. 1959. STREAM CATALOG OF EASTERN SECTION OF KETCHIKAN MANAGEMENT DISTRICT OF SOUTHEASTERN ALASKA. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 305.

Information about part of Southeastern Alaska salmon streams is cataloged from the voluminous records of the Fisheries Research Institute of the University of Washington, U. S. Fish and Wildlife Service, Alaska Salmon Industry, and Alaska Department of Fish and Game, and other agencies. Stream descriptions, maps, historical records, and salmon escapement data are compiled for 117 salmon streams in the eastern section of the Ketchikan fishery management district. Each stream is located geographically by latitude and longitude, and by orientation to prominent land masses. A standard numbering system is used and designations formerly in use and common names of each stream are given. Physical descriptions are grouped for the intertidal zone and the upstream area of each stream. Available records of weather and water temperatures and notes useful to ground and aerial stream surveyors are presented in brief form. The species of salmon utilizing the spawn-

ing grounds and estimates of the escapement magnitude each year for many years are given. (Auth. abst.)

3260. Clemens, Howard P., and Kermit E. Sneed. 1959. LETHAL DOSES OF SEVERAL COMMERCIAL CHEMICALS FOR FINGERLING CHANNEL CATFISH. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 316, 10 pgs.

Includes a list of 60 chemicals, their active ingredients, and the limits of tolerance of fingerling channel catfish exposed to these chemicals.

3261. Clark, John R., Robert Livingstone, Jr., and James M. Crossen. 1959. DEVELOPMENT AND OPERATION OF TELEVISION FOR STUDYING FISH BEHAVIOR IN OTTER TRAWLS. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 320, 21 pgs.

Underwater television equipment (Image Orthicon) used for studying the behavior of fish in otter trawls is described. Development of the equipment, including the television chain itself and the accessory power source, lights, etc., plus some methods of using the equipment are explained. Considerable attention is devoted to problems of operation, particularly to the difficulties in handling the camera cable.

An extensive appendix gives in some detail the specifications of the television equipment used. (Auth. abst.)

3262. Anderson, William W., and Jack W. Gehringer. 1959. PHYSICAL OCEANOGRAPHIC, BIOLOGICAL, AND CHEMICAL DATA--SOUTH ATLANTIC COAST OF THE UNITED STATES, M/V THEODORE N. GILL CRUISE 8. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 303, 227 pgs.

This is the eighth in a series of reports presenting basic data from cruises of the Theodore N. Gill in waters off the South Atlantic coast of the United States.

Background of the investigations; objectives; procedures on station; and chemical, biological, and oceanographic methods and procedures were presented in the report for Cruise 1 (Anderson, Gehringer, and Cohen, 1956). Biological methods and procedures were the same as those modified on Cruise 3 (Anderson and Gehringer, 1957). (Auth. intro.)

3263. Sylvester, Robert O. 1959. WATER QUALITY STUDY OF WENATCHEE AND MIDDLE COLUMBIA RIVERS BEFORE DAM CONSTRUCTION. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 290, 116 pgs.

A water quality study was made in the Wenatchee River Basin and on the Columbia River from Beebe (near Chelan, Washington) to McNary Dam for the purpose of ascertaining the effect proposed dam construction will have on water quality and its relation to aquatic life. Water samples were collected during the period from June 1954 to April 1957. They were analyzed for the common constituents and for other constituents that might affect aquatic life. These

data are summarized and discussed. They are compared with similar data collected in 1910-11. (Auth. abst.)

3264. Jackson, C. F. 1959. A TECHNIQUE FOR MASS-MARKING FISH BY MEANS OF COMPRESSED AIR. New Hampshire Fish and Game Department, Technical Circular No. 17, 8 pgs.

The purpose of this investigation was to develop a method of marking large numbers of fish without the necessity of handling each fish. The method had to be one that would not discolor the fish or render them objectionable to the fishermen. It was found that a substance manufactured by Luminous Resins, Inc. and sold under the trade name of "Derbylite" could be forced under the scales by means of compressed air. This is visible only under fluorescent light and appears to be permanent. (Auth. abst.)

3265. Burnet, A. M. R. 1959. SOME OBSERVATIONS ON NATURAL FLUCTUATIONS OF TROUT POPULATION NUMBERS. New Zealand Journal of Science, Vol. 2, No. 3, pp. 410-421.

Five years' observations on Brown Trout in two small streams have shown that the populations are not in a stable state. There are fluctuations in the survival rates, and variations in the population numbers, weight, and composition. It is suggested that cannibalism is a factor in determining survival rates.

In one of these small streams, the removal of a moderate eel population has had no measurable effect on the trout population. (Auth. summ.)

3266. Smith, Derek C. W. 1959. THE BIOLOGY OF THE RAINBOW TROUT (*SALMO GAIARDNERII*) IN THE LAKES OF THE ROTORUA DISTRICT, NORTH ISLAND. New Zealand Journal of Science, Vol. 2, No. 3, pp. 275-312.

Trout populations were studied in 11 lakes of varied size and environmental characteristics in the Rotorua district. All lakes contained rainbow trout and two also contained brown trout. Temperatures varied seasonally between 7°C and 25°C, and the only two lakes examined were thermally stratified.

Growth of fish is rapid although there is some variation between the lakes. Fish reach 25 to 42 cm in the first year and 30 to 56 cm in the second. Most of the fish mature at this age and little further growth occurs. In most lakes the sexes are equally numerous, but excesses of either males or females occur in some lakes. There appears to be a tendency for males to predominate in old stocks and females in young stocks. Population densities of adult fish are generally between 3 and 10 per acre. The age structure varies considerably, the average age being apparently lowest where good spawning streams are available.

The main food of trout of all sizes was the smelt (*Retropinna* sp.); other important foods were bullies (*Gobiomorphus* sp.) and koura (*Paranephrops* sp.) particularly in the larger trout, and insects mainly of terrestrial origin, particularly in the smaller

trout. Very little evidence of cannibalism was found, although in a few lakes trout taken in the spawning season contained appreciable numbers of trout eggs. (Auth. summ.)

3267. Davis, Jackson. 1959. MANAGEMENT OF CHANNEL CATFISH IN KANSAS. University of Kansas, Museum of Natural History, Miscellaneous Publication No. 21, 56 pgs.

Subjects treated are: Rate of Growth, Growth in Relation to Muddiness of Water; Transfer to Catfish from Kanopolis Reservoir to Other Impoundments, Production in Ponds, and Marking Channel Catfish.

3268. Parisot, Thomas J., and James W. Wood. 1959. FISH MYCOBACTERIOSIS (TUBERCULOSIS). United States Fish and Wildlife Service, Fishery Leaflet 494, 3 pgs.

The only reliable method for detecting this disease is by observing the acid-fast organism in tissue smears stained by the Ziehl-Neelsen method. The etiologic agent is a small (1-3µ x 0.3-0.7µ), non-motile, gram-positive, acid-fast rod belonging to the genus *Mycobacterium*. The source of infection has not been positively established, but in the hatchery fish it is probably infected fish flesh and viscera used as part of the diet. The mode of transmission has not been positively established, but it is thought to be transmitted in the feed. The incubation period has not been positively established. Experimental results indicate that the infection may become established in as short a time as six weeks of light feedings of the organisms. All species investigated appear to be susceptible. The etiologic agent has been found in almost all types of fish and all types of environment. The range is worldwide. Fish mycobacteriosis is chiefly a problem of hatcheries and aquaria, but it is also found in wild populations of fishes. The method of control is to discontinue feeding infected material and improve sanitary measures. No satisfactory therapy treatment is known.

3269. Newman, H. William. 1959. EFFECT OF FIELD POLARITY IN GUIDING SALMON FINGERLINGS BY ELECTRICITY. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 319, 15 pgs.

The relation of field polarity to fish guiding effectiveness was tested under controlled laboratory conditions by using a single-row electrode array sequentially energized so that: (1) positive polarity was always toward the upstream end, (2) positive polarity was always toward the downstream end, and (3) polarity alternated to cancel out polarity orientation. No difference in effectiveness was found demonstrating that fish guiding was due to avoidance rather than to electrotaxis. Variability, measured as variance, decreased as sample size increased but the mean effectiveness was similar for fish release lots of 15, 50, and 100 fish each. (Auth. abst.)

3270. Anonymous. 1957. SYMPOSIUM ON EVALUATION OF FISH POPULATIONS IN WARM-WATER STREAMS. Iowa Cooperative Fisheries Research

Unit, Iowa State College, 118 pgs.

The main topics for discussion were:

- A. Distributional behavior of fishes
- B. Use of nets in evaluating fish populations
- C. Stream survey methods
- D. Electric shockers.

Discussions followed each of these main topics.

Individual papers given were:

- A. Fish behavior as related to stable stream populations, by S. D. Gerking
- B. A study of the tagged fish present in a fishery census station, C. A. Purkett, Jr.
- C. Factors affecting hoop net and trap catches of channel catfish, by R. J. Muncy
- D. A comparison of trap net catches by angler success on some Iowa streams, by R. E. Cleary
- E. Relative efficiency and selectivity of gear used in the study of fish populations in Missouri streams, J. L. Funk
- F. Stream survey methods in the Southeast, by C. E. Ruhr
- G. Stream survey methods in Iowa, with a special report on rotenoning of the Humboldt Area, by H. M. Harrison
- H. A comparison of stream fish population estimates, by C. A. Purkett, Jr.
- I. Trout stream population study techniques employed in Michigan, by D. S. Shetter.

Other discussions included: several types of electric shockers, reasons for surveys and problems of sampling, selection of sampling stations, purposes of survey, stream classification, small-mouth bass requirements and stream management. Bibliographies are included on factors affecting catch per unit effort and on electric shockers.

3271. Noerenberg, Wallace H. 1959. SALMON MIGRATIONS IN SOUTHEASTERN ALASKA. Alaska Fisheries Briefs, U. S. Fish and Wildlife Service, Circular 59, pp. 8-12.

The American fishery recovered about 2 1/2 times as many pink salmon tags as the Canadian fishery in 1957; 16 times as many in 1958. The American fishery recovered a slightly larger number of red salmon tags than did the Canadian fishery in 1957; more than 4 times as many in 1958. Returns of both pink and red salmon from Canadian fishery and spawning grounds were confined almost exclusively to fish tagged at Noyes and Baker Islands in both years. More Canadian returns came from salmon tagged during late July and early August of 1957 than from those tagged during mid and late August of 1957.

3272. McVey, Robert. 1959. GRAVEL REMOVAL AND THE FISHERIES. Alaska Fisheries Briefs, U. S. Fish and Wildlife Service, Circular 59, pp. 14-18.

Removal of gravels from stream beds has resulted in losses to Alaskan fishery resources in past years. Removal operations will be intensified as development of the State and its natural resources progresses. The importance of the fisheries warrants careful consideration of proposed

gravel removal projects. To insure the protection of these resources, it is essential that each proposal be reviewed individually. (Auth. summ.)

3273. Sears, Howard S. 1959. ESTIMATING ABUNDANCE OF SALMON FINGERLING. Alaska Fisheries Briefs, U. S. Fish and Wildlife Service, Circular 59, pg. 19.

In the summer of 1958, 260 sets were made with the lampara seine to evaluate its usefulness in the prediction program. A total of 2,509 fingerling salmon of all five species were taken. The higher catches of this type net over those used heretofore suggest that it may be possible with random sets to relate the average number of fingerling per seine haul to the number of returning adults. (Auth.)

3274. Ross, A. John. 1959. MYCOBACTERIA IN ADULT SALMONID FISHES RETURNING TO FEDERAL HATCHERIES IN WASHINGTON, OREGON AND CALIFORNIA. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 332, pp. 1-9.

The degree of incidence of acid-fast bacillus infections in adult salmonid fishes was determined. The disease was shown to be widely distributed in the area examined. It is believed the primary source of infection is derived from the hatchery practice of feeding infected salmon products to juvenile fish. One group of marked adults that had been hatchery reared for 370 days showed a 62 percent incidence of infection. A statistical analysis indicated that length of fish is independent of infection. (Auth. abst.)

3275. Earp, Brian J. 1959. MYCOBACTERIA IN ADULT SALMONID FISHES RETURNING TO STATE HATCHERIES IN WASHINGTON. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 332, pp. 10-12.

A survey for tuberculosis in salmon returning to hatcheries of the State of Washington Department of Fisheries situated in the Columbia River Basin was conducted. Chinook salmon (*Oncorhynchus tshawytscha*) and silver salmon (*Oncorhynchus kisutch*) were examined for the presence of acid-fast bacteria. Tissues were examined by the standard bacteriological smear technique and by a method designed to concentrate the bacteria dispersed throughout the liver tissue. (Auth. abst.)

3276. Westgard, Richard L. 1959. A PROCEDURE FOR THE DETECTION OF ACID-FAST BACTERIA IN FISH: A COMPARATIVE STUDY OF DIGEST-CONCENTRATE VS. SMEAR TECHNIQUE. (Addendum) United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 332, pp. 13-17.

A method has been developed to detect the presence of acid-fast organisms and to determine their relative number in fish tissue. This digest-concentrate method detects the presence of small numbers of organisms and those which are grouped in isolated tubercles which might escape detection with the standard smear technique. A comparative study was

made between this digest-concentrate and the standard smear technique. Of 1,234 fish livers examined, 41 or 3.3 percent were positive by the smear method and 56 or 4.5 percent were positive by the digest-concentrate technique. This is a 36.4 percent increase in positives of the latter over the first. A combination of both methods gave a total of 77 positives or 6.2 percent of the number examined; a yield of 87.9 percent increase over the smear method and 37.8 percent increase over the digest-concentrate. (Auth. abstr.)

3277. Wood, James W. 1959. A SURVEY OF TUBERCULOSIS IN PACIFIC SALMON AND STEEL-HEAD TROUT IN OREGON STREAMS IN 1957. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 332, pp. 18-34.

A survey for tuberculosis in anadromous salmonid fishes was conducted in Oregon streams in 1957. Fish for examination were collected from the commercial gill-net fishery landings on the Columbia River, at hatchery egg-collecting stations, and from fish of natural origin on the spawning grounds. An estimated 4.9 percent of spring-run chinook salmon (*Oncorhynchus tshawytscha*), 2.9 percent of summer-run chinook, 5.6 percent of fall-run chinook, 9.2 percent of silver salmon (*O. kisutch*), 0.6 percent of blueback (*O. nerka*), and 1.3 percent of steelhead trout (*Salmo gairdnerii*) caught by the gill-net fishery in 1957 were tuberculous. The incidence of tuberculosis in stocks of salmon returning to hatchery egg-collecting stations was generally much higher. No evidence of tuberculosis was found in silvers and fall chinook of probable natural origin on the spawning grounds. Fish heavily infected with tuberculosis were generally of smaller size than those lightly or non-infected. (Auth. abstr.)

3278. Seguin, Rosemarie T. 1959. WEAKFISH EGGS. University of Delaware, Estuarine Bulletin, Vol. 4, No. 2, pp. 3-5.

The changes of ovary and of the eggs which take place while the eggs are still within the ovary are described.

3279. Almquist, Elisabeth. 1959. OBSERVATIONS ON THE EFFECT OF ROTENONE EMULSIVES ON FISH FOOD ORGANISMS. Institute of Freshwater Research, Report No. 40, pp. 146-160.

During summer and fall 1958, the effect of rotenone emulsives upon fish food organisms was studied in connection with fish poisoning in three lakes in Central Sweden. Most of the zooplankton, much of the epiphytic and bottom animals and some of the phytoplankters were totally killed by 0.5 - 0.6 ppm., the concentration generally used in fish eradicating. (Auth. summ.)

3280. Lebkova, N. P. 1958. DEVELOPMENT OF THE EYE IN THE LAMPREY IN CONNECTION WITH CERTAIN PECULIARITIES OF ITS ECOLOGY. Doklady, Akademii Nauk, SSSR, Vol. 118, No. 4, pg. 845.

In newly-hatched larvae (3-4 mm in length) it is possible to see eye rudiments on either side of the head which appear as light spots on a darker background. After several days the eyes become grayish in color and become distinctly visible. The eye remains distinct for a period of 30-40 days after hatching, when the larvae reach 1-1.5 cm in length. In older larvae taken from the mud, the eyes may not be seen even under magnification. Adult animals have well developed eyes. Thus there occurs a disappearance as it were of a previously evident organ, and its subsequent reappearance after metamorphosis. A study of histological preparations has shown that the eye in a young larva for about two months retains a vesicular form and shows no indications of transformation into an optic cup. We have observed a distinct photo-negative reaction in a larva with vesicular eyes. When these observations are considered together with the characteristic morphological structure of the organ and the data presented earlier on the ecology of the lamprey larvae, then it is possible to suppose that the vesicular eye of the young larva is a functional, light-sensitive organ. In general, the structure of the eye of the larva at this age reflects the adaptation to life within gravel. At no stage of development of the lateral eye of the lamprey have we found any regressive characteristics. It seems to us that the view that the lateral eyes of the lamprey are reduced organs must be now definitely abandoned. The eyes must be considered as fully functional sight organs, adapted to the changing environment at each stage of development of the animal.

3281. Sokolova, G. A., and Iu. I. Sorokin. 1958. DETERMINATION OF THE RATE OF BACTERIAL SULFATE REDUCTION IN THE BOTTOM DEPOSITS OF THE GOR'KOVSKOE RESERVOIR, USING S^{35} . Doklady, Akademii Nauk, SSSR, Vol. 118, No. 2, pg. 404.

The results obtained show that in mud deposits of newly-formed reservoirs hydrogen sulfide will be formed at the expense of sulfate reduction. It is probable that the accumulation of hydrogen sulfide in the mud will have an adverse effect on the winter oxygen conditions of such water.

3282. Neifakh, A. A., and N. N. Rott. 1958. THE WAYS IN WHICH RADIATION DAMAGE APPEARS IN EARLY DEVELOPMENT IN FISH. Doklady, Akademii Nauk, SSSR, Vol. 119, No. 2, pg. 261.

Fertilized groundling (*Misgurnus fossilis*) and sturgeon (*Acipenser stellatus*) eggs were irradiated (10,000 r) at stages from fertilization to middle gastrulation. Preliminary tests showed that there were no regular changes in radiosensitivity related to the nuclear division cycle at doses over 3000 r. The high dose was therefore chosen to give unambiguous and simultaneous reactions which were only related to the stage of development in all cases. The nuclei act at early stages in such a way as to ensure development to the later stages. High doses suppress the nuclear activities, so subsequent development can only proceed as far as the stage which had already

been prepared.

3283. Hartman, Wilbur L. 1959. BIOLOGY AND VITAL STATISTICS OF RAINBOW TROUT IN THE FINGER LAKES REGION, NEW YORK. New York Fish and Game Journal, Vol. 6, No. 2, pp. 121-178.

A joint study of the rainbow trout in Cayuga, Seneca, Skaneateles and Canandaigua Lakes, and their major spawning tributaries, was carried on from 1953 to 1957 by the New York State Conservation Department and Cornell University. Substantial populations in these waters are being maintained by natural propagation. Spawning runs were sampled each spring; 2,803 adult fish were examined and tagged, and scale readings were recorded for 2,513. Life history data for the first four years, as well as tag returns and creel-census records for 1957, are summarized.

Large numbers of fry hatched each year in these tributaries. Some also served as satisfactory nursery areas holding many parr for as long as 3 years. This influenced the time spent in lake waters before fish returned to the streams to spawn. As an average, males spawned for the first time at a younger age than females. Few of either sex spawned more than once.

The proportion of these populations taken by stream fishing was much greater than that by lake fishing. Natural mortality was estimated to be about double the loss from angling.

Maintenance and improvement of stream conditions are fundamental to the future of the rainbow trout fishery in the Finger Lakes region. At the same time, the data indicate that the fishery is not fully utilizing the adult populations. Extension of the lake-fishing season into the fall months appears to be the most practical means at present of fostering an increased harvest. (Auth. abst.)

3284. Haskell, David C. 1959. TROUT GROWTH IN HATCHERIES. New York Fish and Game Journal, Vol. 6, No. 2, pp. 204-239.

Water temperature, species and feeding level are major factors that affect trout growth. Data for brook trout are analyzed to show that hatchery trout having adequate food will remain constant in body form for at least 1 1/2 years and, at a particular temperature, will increase in length at a constant rate. Also, the cube root of the weight is proportional to the length. A table is included giving the relationship of weight to length for brook trout, brown trout and rainbow trout.

If an estimate of the rate of increase in length is known, expected daily percentage gains in weight for trout of various sizes may be calculated. These, multiplied by the proper conversion factor, give the amount of food to be fed daily in terms of percentage of body weight. These values are inversely proportional to the length.

When a pond holds a maximum population density of trout, the amount of food required will remain the same regardless of trout species, fish size or water temperature. Hence, that amount may be

considered to be a single criterion of its carrying capacity. From it, one may calculate the quantity of trout that the pond will hold under various conditions, if the corresponding rates of increase in length are known. At different temperatures, the quantity of trout of a given size that may be held will differ. But, at a particular temperature, the permissible weights of trout of different sizes will be proportional to their lengths.

A temperature-unit system for studying growth when temperature varies is described, and its use for predicting the relative growth of trout when transferred from one hatchery to another is discussed. The application of statistics to trout growth data is also discussed. (Auth. abst.)

3285. Sommani, E. 1954. LAKE LUNGO -- HYDROBIOLOGICAL CHARACTERISTICS OF A BRACKISH ENVIRONMENT. GENERAL AND BIOLOGICAL OBSERVATIONS. Boll. Pesca Piscic. Idrobiol., 1954 9(N.S.), No. 1, 30-53; Water Pollution Abstracts, Vol. 33, No. 3, Abst. No. 465. 1960.

The author reports observations on the morphological, hydrological, physico-chemical, and biological characteristics of Lake Lungo, a brackish-water lake of the Tyrrhenian coast, situated between Rome and Naples. Observations on the plankton and benthic fauna are tabulated and compared with results for other brackish-water ponds along this coast. The lake receives small and irregular contributions of both fresh and sea water.

3286. Templeman, Wilfred, and H. J. Squires. 1960. INCIDENCE AND DISTRIBUTION OF INFESTATION BY *SPHYRION LUMPI* (KRØYER) ON THE REDFISH, *SEBASTES MARINUS* (L.), OF THE WESTERN NORTH ATLANTIC. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 1, pp. 9-31.

Investigations of infestation of redfish by female *Sphyrion lumpi*, in the Newfoundland area, showed that in the Labrador area *Sphyrion* were generally distributed all over the body but with the greatest infestation in the cloacal region. In the eastern Grand Bank area there was a strongly ventral distribution of the parasite on the trunk with over 40% of the parasites in the cloaca. This is contrasted with previously published data from the Gulf of Maine where most of the *Sphyrion* were situated antero-dorsally, near the base of the spiny first dorsal fin.

The major centre of infestation in the Newfoundland area, of redfish by *Sphyrion* was off southern Labrador east of Hamilton Inlet Bank with as high as 8% of the redfish infested. Centres of least infestation were found on the southern part of the eastern slope of the Grand Bank and in the southeastern part of the Gulf of St. Lawrence. *Sphyrion* were very scarce on the southwestern Grand Bank, the western part of the south coast of Newfoundland and in the northern part of the Gulf of St. Lawrence. *Sphyrion* were not noted on redfish from the NE Grand Bank, Flemish Cap and from the Nova Scotian Shelf. A study of residual remains, in redfish fillets, of the cephalo-

thorax from individuals of previous *Sphyryon* generations showed the same centres of abundance but with some spreading of the previously infested fish in 2 of 3 areas in the direction of the deep-water current, thus indicating the possibility of very slow migration of some individual redfish with the current.

It is believed that almost all the redfish discussed in this paper are of the *mentella* type. (Auth. abst.)

3287. Tully, J. P., A. J. Dodimead, and S. Tabata. 1960. AN ANOMALOUS INCREASE OF TEMPERATURE IN THE OCEAN OFF THE PACIFIC COAST OF CANADA THROUGH 1957 AND 1958. *Journal of the Fisheries Research Board of Canada*, Vol. 17, No. 1, pp. 61-80.

The temperature increase extended from the surface to nearly 500 m depth. Its progress is shown by temperature distribution on the isopycnal surface, $\sigma_t = 26.00$, which is in the halocline, immediately below the depth of seasonal influence. During this period the currents veered northward and strengthened. The spawning migration of sockeye salmon (*Oncorhynchus nerka*) in the ocean was shifted northward and delayed in association with these anomalous oceanographic conditions. (Auth. abst.)

3288. Tully, J. P., and F. G. Barber. 1960. AN ESTUARINE ANALOGY IN THE SUB-ARCTIC PACIFIC OCEAN. *Journal of the Fisheries Research Board of Canada*, Vol. 17, No. 1, pp. 91-112.

It is shown that the features of an estuarine system occur northward of a sub-Arctic boundary in the Pacific Ocean.

The limit of downward mixing from the surface is the limit (L) of the halocline. This is defined by a discontinuity in the logarithmic plot of salinity structure, where the salinity is nearly constant (33.8 ± 0.1 ‰). On this surface the transfer is uni-directional upward. Here the water masses being entrained into the halocline and upper zone may be identified by their temperature alone. (Auth. abst.)

3289. Idler, D. R., and I. Bitners. 1960. BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION. IX. FAT, PROTEIN AND WATER IN THE MAJOR INTERNAL ORGANS AND CHOLESTEROL IN THE LIVER AND GONADS OF THE STANDARD FISH. *Journal of the Fisheries Research Board of Canada*, Vol. 17, No. 1, pp. 113-122.

Absolute changes in fat, protein and water of all major internal organs and free and esterified cholesterol of the liver and gonads of standard male and female sockeye salmon (*Oncorhynchus nerka*) during the 1957 Fraser River spawning migration to Stuart Lake are discussed. The alimentary tract is the major source of fat and protein from the internal organs and the greater part of this reserve is expended in the first 250

miles (403 km) of the river migration. The testes consumed only 0.5% of the energy expended from the body of the standard male while the ovaries consumed 8% of the energy expended from the body of the standard female. (Auth. abst.)

3290. Jonas, R. E. E., and R. A. MacLeod. 1960. BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION. X. GLUCOSE, TOTAL PROTEIN, NON-PROTEIN NITROGEN AND AMINO ACID NITROGEN IN PLASMA. *Journal of the Fisheries Research Board of Canada*, Vol. 17, No. 1, pp. 125-126.

The results shown indicate that the downward trend in the glucose levels in male fish over the migration route is appreciably greater than might be expected from blood dilution, reported to be about 12% for *O. tshawytscha* (Greene, 1926). It is also evident that the pattern of glucose changes was somewhat different in the male and female fish. The marked drop in total protein in both males and females was also greater than might be accounted for by blood dilution. The significant drop in non-protein nitrogen during the early phase of migration and the subsequent rise to values higher than those found initially in the later phase is not unlike the changes observed in the Na^+ level of the flesh of migrating salmon (MacLeod et al, 1958). The NPN drop in the plasma by the time the salmon reached Lillooet, followed by a rise at Forfar Creek farther up the Fraser River, parallels the changes in plasma sulphate and urea in these fish (Idler and Tsuyuki, 1958). That the NPN changes cannot be accounted for by differences in amino acid levels at the various sites is also evident from the results shown.

3291. Templeman, Wilfred, and E. J. Sandeman. 1959. VARIATIONS IN CAUDAL PIGMENTATION IN LATE-STAGE PRE-EXTRUSION LARVAE FROM MARINUS- AND MENTELLA-TYPE FEMALE REDFISH FROM THE NEWFOUNDLAND AREA. *Journal of the Fisheries Research Board of Canada*, Vol. 16, No. 6, pp. 763-789

Late stage pre-extrusion larvae have been examined from 37 *marinus*-type and 44 *mentella*-type redfish, obtained from three localities in the Newfoundland area. Examination of 120 larvae from each fish has revealed that a difference exists between the two types, in the relative presence or absence of caudal melanophores in their larvae. The caudal melanophores, when present, are situated near the base of the caudal fin and ventral to the vertebral column. Caudal melanophores were absent in only 2.3% of the larvae from *mentella*-type parents in contrast to the absence of caudal melanophores in 76.1% of the larvae from *marinus*-type parents. When only those larvae having caudal melanophores are considered, larvae from *marinus*-type parents usually have but a single melanophore whereas those from *mentella*-type parents usually have two caudal melanophores.

The difference between larval samples provides evidence of the existence of a real genetic difference between *mentella*- and *marinus*-types of redfish in

the Northwest Atlantic. (Auth. abst.)

3292. McKenzie, R. A. 1959. MARINE AND FRESHWATER FISHES OF THE MIRAMICHI RIVER AND ESTUARY, NEW BRUNSWICK. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 6, pp. 807-833.

The Miramichi is the largest river in north-eastern New Brunswick. The watershed covers an area of about 3,500,000 acres. Its waters support commercial fisheries valued at about \$1,250,000 in 1952 and 1953. The commercial fisheries are located in the tidal waters which extend inland about 50 miles. The fresh waters extend inland about another 100 miles. Water temperatures range from -1.6°C in winter to 25°C in summer and the salinities from 0 ‰ to 30 ‰.

Thirty-eight families represented by at least 78 species of fishes have been found in the waters of the Miramichi system. Of the species, 53 are marine, 7 anadromous, 1 catadromous, and 17 freshwater. (Auth. abst.)

3293. Smith, M. R. 1959. PHOSPHORUS ENRICHMENT OF DRAINAGE WATERS FROM FARM LANDS. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 6, pp. 887-895.

Excellent production of brook trout (*Salvelinus fontinalis*) and drainage from a stabilized agricultural area are associated in the streams and ponds of Prince Edward Island. Determinations of phosphorus content of Ellerslie Brook, P.E.I., showed major contributions from commercial fertilizers applied to cultivated land. The inference appears valid that commercial land fertilizers are an important factor in maintaining high trout production, and may enhance oyster production in shallow salt-water inlets at the mouths of the streams. (Auth. abst.)

3294. Ricker, W. E. 1959. ADDITIONAL OBSERVATIONS CONCERNING RESIDUAL SOCKEYE AND KOKANEE (*ONCORHYNCHUS NERKA*). Journal of the Fisheries Research Board of Canada, Vol. 16, No. 6, pp. 897-902.

During the 1920's, plantings of anadromous sockeye fry in small barren lakes tributary to Stuart Lake produced (in addition to smolts) lake-maturing "residual" sockeye dull in colour at maturity. The samples taken contained a large excess of females. The kokanee of Cultus Lake, caught in 1934-35, were all of one year-class and are now believed to have been progeny of Kootenay Lake (West End) kokanee eggs hatched and reared at Cultus Lake, though not intentionally planted there. These kokanee were of a bright colour at maturity, like their parent stock, and matured mostly at age 2+. (Auth. abst.)

3295. Qadri, S. U. 1959. SOME MORPHOLOGICAL DIFFERENCES BETWEEN THE SUBSPECIES OF CUTTHROAT TROUT, *SALMO CLARKII CLARKII* AND *SALMO CLARKII LEWISI*, IN BRITISH COLUMBIA. Journal of the Fisheries

Research Board of Canada, Vol. 16, No. 6, pp. 903-922.

Coastal cutthroat trout, *S. c. clarkii* Richardson occupy most lakes and streams of coastal British Columbia, including the adjacent islands. Yellowstone cutthroat, *S. c. lewisi* (Girard), occupy south-eastern British Columbia; their range is separated from that of the coastal subspecies by a zone lacking cutthroat trout. A map showing all natural distribution records in the province is presented. From 60 to 146 specimens were examined for distinguishing characters. Spots below the lateral line are more numerous towards the anterior end in *S. c. clarkii*, but more numerous towards the posterior end in *S. c. lewisi*. A plot of spot number in selected areas of the body provides almost complete separation of individuals of the two subspecies. Significant differences also occur in certain scale counts and in body and peduncle depth, although these characters overlap considerably between the subspecies. No difference was found in vertebral count. (Auth. abst.)

3296. Neumann, J. 1959. MAXIMUM DEPTH AND AVERAGE DEPTH OF LAKES. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 6, pp. 923-927.

By considering data of maximum depth and average depth for 107 lakes, it is suggested that an 'elliptic sinusoid' closely approximates the average shape of lake beds. The elliptic sinusoid is defined as a geometric body whose base is an ellipse such that planes perpendicular to the base ellipse passing through the centre of the latter intersect the surface of the body along troughs of sine curves. The results are capable of practical application. (Auth. abst.)

3297. Pritchard, A. L. 1959. THE EFFECTS ON FISHERIES OF MAN-MADE CHANGES IN FRESH WATER IN THE MARITIME PROVINCES. The Canadian Fish Culturist, Issue Twenty-five, October 1959, pp. 3-6.

As would be expected, particularly in New Brunswick, Nova Scotia and perhaps Newfoundland, the forest industry must be held responsible for the major environmental changes affecting fish. These have been either directly or indirectly responsible for reducing the productivity of some of the finest streams in salmon, alewives, smelt and other anadromous fish. Direct action has been taken to erect dams to create head ponds to store water for log driving and mills. Dams and jams have resulted from log drives and logging slash. A few of these might only have been temporary obstructions, but I am afraid that the vast majority at one time or another provided complete blocks which prevented spawning runs from reaching their destination. An added threat has been the destruction of spawning grounds and the eggs and fry therein through the physical action of log drives. Logging has undoubtedly changed the environment through the removal of large blocks of timber. Also associated with the forest industry but hardly its fault, is the necessity for control of forest insect pests. The mills and

pulp plants must also accept some blame. Hydro-electric installations have had their direct and indirect effects on fish in the Maritimes area. Main stream dams, the usual type in the Maritimes, even when provided with fishways, inevitably seem to cause delay to ascending adults. Main stem installations also alter stream conditions above the dam, flooding out spawning grounds, and changing the productive capacity of the nursery areas. Downstream migrants are also affected. Only a few diversion type power installations are found in the Maritimes, but the problems which they pose for fish are equally if not more complex. Agriculture, superficially an innocent industry which normally has similar objectives of water and soil conservation, as does fisheries, has created some complex problems in the Maritimes. In recent years there has been a trend toward the development of somewhat unique flood control structures known locally as aboideaux. These are in effect dams to prevent tidal waters from inundating low marshland areas near the river mouths and thus reclaim from the sea agricultural land. The large difference in tide level in the area where aboideaux are most effective in recovering land, e.g. Bay of Fundy, practically eliminates the use of conventional fish passes. Agriculture has been indirectly responsible for introducing toxic chemicals into some streams. It is well known that the mining industry may adversely affect freshwater streams by releasing sludge and toxic chemicals. Road building has frequently been responsible for undesirable changes through filling, dredging and improperly designed culverts. It would appear from this presentation that everything is against fish and that there is no hope in the Maritimes. This idea should be dispelled because in the overall there is an appreciation of the fisheries interest. We must be prepared to suggest and implement the remedies.

3298. Vladykov, Vadim D. 1959. THE EFFECTS ON FISHERIES OF MAN-MADE CHANGES IN FRESH WATER IN THE PROVINCE OF QUEBEC. The Canadian Fish Culturist, Issue Twenty-five, October 1959, pp. 7-12.

In the case of Quebec we shall mention only three types of human activities which adversely affect the local fish and fisheries. 1. Paper industry. The principle abuses by this very important industry can be summarized as follows: fast thaw of snow, quick run-off rain, and reduction in food supply especially for young fish (trout and salmon) due to excessive cutting of surrounding trees; building of roads for hauling logs; construction of dams to store water to drive pulp wood or operate hydro installations; and finally pollution of waters by bark, sawdust and industrial wastes. 2. Mining Industry. One example is given. 3. St. Lawrence Seaway. The changes in the St. Lawrence River due to the different undertakings in connection with the seaway are unfavourably affecting the local fisheries. We can suppose that the dynamiting and dredging of the channel have killed the fish found nearby. However, the

exact causes of this mortality were not established. We suspect also that the tremendous quantities of cement used could easily raise the alkalinity of the surrounding water to the danger point. Another very unusual observation is that in 1957, throughout the St. Lawrence River, adult striped bass, which spawn in the Lake St. Peter area, were apparently reduced to a very small number. The exact reason for the reduction of the bass is unknown. 4. Man Helps Nature. The snow goose (*Chen hyperborea*) and Canada goose or outards (*Branta canadensis*) sojourn some months in Quebec in the spring and fall, during their migratory flights. There were, in 1957, about 20,000 Canada geese, weighing the average nine pounds. Thanks to the protective steps taken by the authorities of the Quebec Department of Game and Fish and especially by the late Superintendent, Mr. Charles Fremont, the number of snow geese reached an estimated 100,000 in 1957. We consider both species of geese as very beneficial to local fish, due to the fertilizing effects of their guano in producing live fish food.

3299. Miller, Richard B., and Martin J. Paetz. 1959. THE EFFECTS OF POWER, IRRIGATION, AND STOCK WATER DEVELOPMENTS OF THE FISHERIES OF THE SOUTH SASKATCHEWAN RIVER. The Canadian Fish Culturist, Issue Twenty-five, October 1959, pp. 13-26.

Power projects on high altitude lakes and rivers have proven to be, in Alberta, uniformly deleterious to the sport fishery. Trout and char fisheries which existed in the lakes prior to the power developments have deteriorated very markedly. On the whole, physical and chemical conditions and the plankton have been little affected; the bottom fauna has usually suffered profound changes, particularly littoral forms which are eliminated by fluctuating water levels. The trout have become scarce partly because of this change in bottom food, but mainly because of the elimination of suitable spawning gravels. At present there is no promising management scheme in sight for these power lakes.

Power projects on rivers and streams have not increased the productivity of sport fishes beyond the level that existed in the rivers before damming. The reservoirs are characterized by high silt loads, low plankton and bottom fauna and sparse fish faunas. The fluctuating water levels rule out any useful management scheme.

Irrigation dams and diversions and stock-watering projects, all at lower altitudes than power projects, lie in more fertile soil and are considerably warmer. This gives them an inherently greater productive potential. In addition, the majority is subject to much less draw-down than mountain developments. These advantages are reflected in the fish production. The large reservoirs have developed valuable commercial fisheries for whitefish and pike and sport fisheries for pike. Little or no success has been achieved in attempts to establish trout fisheries in them. The small reservoirs which acquired a coarse fish fauna at the time of their construction have provided good pike angling; those

where coarse fish could be excluded have been stocked with rainbow trout. The trout grow extremely well and have provided some excellent angling. However, the angling degenerates as a residual population of large trout accumulates. Some of these may be managed by lowering fall water levels to create winter kills, but most of them constitute, at present, an unsolved management problem. (Auth. concl.)

3300. Larkin, P. A. 1959. THE EFFECTS ON FRESH WATER FISHERIES OF MAN-MADE ACTIVITIES IN BRITISH COLUMBIA. The Canadian Fish Culturist, Issue Twenty-five, October 1959, pp. 27-59.

There can be no question that historically, extensive clear cut logging has had deleterious effects on population of freshwater and anadromous fish, particularly in coastal areas. However, the recent trend to sustained yield management of forest resources together with the inclusion of practices in logging which are designed to protect fisheries resources, will no doubt greatly mitigate these effects in the future. At the same time, other trends in modern forestry practices are causing substantial concern to fisheries agencies. The indiscriminate spraying of large areas of forest for insect control is known to have disastrous effects on fish in streams. If forest spraying is to be carried on in the future on a large scale--and there are indications that it may be--fisheries agencies will require a greatly increased knowledge in this field upon which to base sound conservation measures.

In general, the effects of agriculture on fisheries in British Columbia can be regarded as relatively unimportant at the present time. Losses of fish in irrigation diversions have been reduced by screening. Reduction of flow in streams and storage dams on small lakes have had harmful effects but every effort has been made to minimize losses. Soil conservation practices have lessened the harmful effects of silt in streams. Flood control programmes have been studied from the fisheries viewpoint and have incorporated fish protection measures. With complete inspection of all water license applications an established routine there is every reason to believe that the present situation can be maintained.

Generally speaking, the mining industry of British Columbia poses a potential threat chiefly to the sport fishery of the province. Damage to the sport fishery can arise mainly from two phases of mining activity which may be described as mining and processing. In placer gold mining it is the actual mining operation that adversely affects the sport fishery while in the case of other minerals it is the waste products of the processing operation which can cause harm.

It must be concluded that to date the effects on fisheries of power development in British Columbia have been relatively slight. None of the major salmon producing rivers has yet been involved. For all recent projects facilities have been provided that should ensure partial or complete protection for fish populations.

Of necessity, many of the installations have been experimental, and careful study of their effectiveness will prove extremely valuable (Hourston et al, 1955). At present, pollution effects on fisheries are relatively minor and under control in B. C. but with increasing industry and population, problems will undoubtedly multiply. Effects on fisheries of man-made activities in British Columbia have fortunately been a minor factor in fisheries conservation to date.

3301. DeWitt, John W., and E. O. Salo. 1960. THE HUMBOLDT STATE COLLEGE FISH HATCHERY: AN EXPERIMENT WITH THE COMPLETE RECIRCULATION OF WATER. Progressive Fish-Culturist, Vol. 22, No. 1, pp. 3-6.

To overcome the difficulties presented by the lack of a suitable water supply for the operation of a fish hatchery on the Humboldt State College campus, a system which continuously recirculates water through the hatchery has been installed. Once the system of ponds, troughs, and conduits is filled with water, it is recirculated by electric pumps and gravity flow. The water is filtered and aerated continuously. The system operates on a minimum supply of about 10 gallons per minute, but the induced flow through each pond or trough is from 25 to 75 gallons per minute. Water conditions remain favorable even during periods of heavy rainfall and reduced summer water supplies. Representative data on physical and chemical water conditions are presented. (Auth. abst.)

3302. Buss, Keen, and Raymond McCreary. 1960. A COMPARISON OF EGG PRODUCTION OF HATCHERY-REARED BROOK, BROWN, AND RAINBOW TROUT. Progressive Fish-Culturist, Vol. 22, No. 1, pp. 7-10.

A comparison of egg production of hatchery-reared brook (*Salvelinus fontinalis*), brown (*Salmo trutta*), and rainbow (*Salmo gairdneri*) trout was made. The volume and number of eggs produced per pound of fish were computed. These data from 2-, 3-, and 4-year-old brood fish revealed that rainbow trout generally produce less than half as many eggs per pound of fish as do brook and brown trout. Therefore, other factors being equal, the cost of producing rainbow trout eggs was double the other two species. (Auth. abst.)

3303. Lewis, William M., and Michael Bender. 1960. HEAVY MORTALITY OF GOLDEN SHINERS DURING HARVEST DUE TO A BACTERIUM OF THE GENUS *AEROMONAS*. Progressive Fish-Culturist, Vol. 22, No. 1, pp. 11-14.

Aeromonas is recognized as the most important genus of bacterial pathogens of warm-water fishes. In the present work it was found to cause heavy mortality of golden shiners (*Notemigonus crysoleucas*) when these fish were harvested and moved to holding tanks. Symptoms involved loss of color, swimming at the surface, and--among larger fish--development of large saddle-shaped areas of infection on the back.

Once a population of shiners is infected with *Aeromonas*, it appears to remain infected at least 2

to 3 months in the summer. The infection becomes acute when the fish are harvested and held in tanks.

The organism under study was easily isolated. It was readily transmitted by injection and inoculation of surface abrasions.

Sensitivity tests indicated the pathogen to be particularly sensitive to aureomycin, Chloromycetin, Terramycin, and tetracyclin. (Auth. abst.)

3304. McCaig, Robert S., James W. Mullan, and Cheney O. Dodge. 1960. FIVE-YEAR REPORT ON THE DEVELOPMENT OF THE FISHERY OF A 25,000-ACRE DOMESTIC WATER SUPPLY RESERVOIR IN MASSACHUSETTS. *Progressive Fish-Culturist*, Vol. 22, No. 1, pp. 15-23.

Changes in the angler harvest from Quabbin Reservoir, the main water supply for Metropolitan Boston, during the period 1954 through 1958 are described.

On the basis of 16,850 acres open to fishing, 13.7 hours have been expended annually to harvest seven fish weighing 2.5 pounds per acre. In 1954, game fish--trout, bass, and pickerel--made up 2.1 percent numerically and 11.1 percent by weight of the harvest. By 1958, these values had risen to 5.4 and 23.0 percent, but pan fish--principally yellow perch, white perch, and brown bullhead--continued to constitute the bulk of the harvest. The success of lake trout fingerling plantings made since 1952 largely accounted for the increased game-fish catch. Lake trout first appeared in the catch in 1956, when 67 were caught. In 1958, 1,340 lake trout (4,964 pounds) were harvested. Successful introduction of smelt as forage played an integral role in these results. Prior to the establishment of a significant smelt population, the lake trout reached the legal size of 18 inches sometimes during their fifth year of life. With a plentiful supply of smelt, growth has been accelerated and legal size is being attained sometime during the fourth year of life. (Auth. abst.)

3305. Phillips, Elmer S., and Dwight A. Webster. 1960. IMPROVEMENTS IN A MICROPROJECTOR FOR FISH SCALES. *Progressive Fish-Culturist*, Vol. 22, No. 1, pp. 24-29.

The improvements made in a conventional microprojector are described, including drawings for and construction of the unit, the mounting of the optical equipment, and adaptations for photography. Features of the improved microprojector include (1) increased leg room under the projection screen; (2) redesign of the optical and mirror system to permit greater ease in placing scale specimens and in focusing; (3) use of a fixed objective and movable specimen stage for focusing, which permits accurate reproduction of magnifications for any given lens system; and (4) addition of an interchangeable back-projection surface, which permits the substitution of a standard photographic plateholder and thus allows use of the apparatus for making photographic negatives or prints directly. (Auth. abst.)

3306. Pyle, Earl A. 1960. NEUTRALIZING CHLORINE IN CITY WATER FOR USE IN FISH-DISTRIBUTION TANKS. *Progressive Fish-Culturist*, Vol. 22, No. 1, pp. 30-33.

Water containing 0.5, 1.0, or 1.5 ppm chlorine (all within permissible limits of municipal water systems) was toxic within several hours to brook trout (*Salvelinus fontinalis*) and smallmouth bass (*Micropterus dolomieu*) fingerlings. Brook, rainbow (*Salmo gairdneri*) and brown trout (*Salmo trutta*) fingerlings and smallmouth bass fingerlings exhibited no distress over a 24-hour period when exposed to a 1% solution of technical sodium thiosulfate (an amount 5,000 times greater than needed to neutralize 1 ppm chlorine). The products of neutralization of chlorine with technical sodium thiosulfate were nontoxic to the test fish. For each 100-gallon volume of the fish-distribution tank, 20 grams of technical sodium thiosulfate will provide a large margin of safety in neutralizing the chlorine in any municipal water that is to be used in transporting fish. (Auth. abst.)

3307. Wilber, Charles G. 1960. PHARMACOLOGICAL STUDIES ON THE MELANOPHORES IN *FUNDULUS HETEROCALITUS*. *Progressive Fish-Culturist*, Vol. 22, No. 1, pp. 34-37.

Ten specimens of *Fundulus* as controls and 10 as experimentals were used in each test. OMPA was administered by intraperitoneal injection (0.5 ml of distilled water containing 1/40 ml of pure OMPA per fish) and by immersion of the fish in mixtures of 3 g of OMPA per liter of sea water. In all tests, light specimens of *Fundulus* were darkened; the melanophores were in the dispersed state. Hexamethonium bromide and decamethonium bromide were injected (0.5 ml of distilled water containing 5 mg of drug) into the *Fundulus*. Light fish were darkened after the hexamethonium treatment; dark fish were rendered light after the decamethonium injection. Neither drug was effective if fish were immersed in solutions. Treatment of *Fundulus* with OMPA by injection or by immersion renders light specimens dark. The OMPA is transformed in the fish into an anticholinesterase product, and the fish is darkened by the resulting accumulation of acetylcholine. Injection of hexamethonium into a light *Fundulus* darkens the fish. The effect is explained on the basis of central nervous depression by the drug resulting in blocking of impulses via the adrenergic pigment-concentrating neurones. Injection of decamethonium into a dark *Fundulus* renders the fish light. The mechanism of action is obscure. (Auth. abst.)

3308. Vincent, Robert E. 1960. EXPERIMENTAL INTRODUCTIONS OF FRESH-WATER ALEWIVES. *Progressive Fish-Culturist*, Vol. 24, No. 1, pp. 38-42.

Fresh-water dwarf alewives (*Alosa pseudoharengus*) from Cayuga Lake, New York, were transplanted to determine whether self-sustaining populations could be established. Transporting eggs or fry was impractical because of a prolonged spawn-

ing period. Transportation of mature adults, which had been a problem to other workers, was successfully accomplished. Careful handling was necessary. On the longest haul made, an 8-hour trip, alewife mortality was 10%. After mid-July, when the fish were partially spawned, hauling mortality increased. Satisfactory reproduction and growth of the transplanted fish occurred in a farm pond and in a deep lake. (Auth. abst.)

3309. Isom, Billy G. 1960. OUTBREAKS OF COLUMNARIS IN CENTER HILL AND OLD HICKORY RESERVOIRS, TENNESSEE. *Progressive Fish-Culturist*, Vol. 22, No. 1, pp. 43-45.

The first fish mortalities due to *Chondrococcus columnaris* in Tennessee's natural waters were investigated on May 7, 1959. There was a heavy mortality on the game-fish population, especially the black basses (*Micropterus salmoides* and *M. dolomieu*), in Center Hill Reservoir.

Another fish kill due to this pathogen was investigated on May 15, 1959, on Old Hickory Reservoir. Here the white crappie (*Pomoxis annularis*) was the principal species affected.

These mortalities were probably an indirect result of unusually high temperatures early in May, and also of the occurrence of the disease at spawning time, a period when fish vitality is at its lowest and when closer contact among the fish is inevitable. (Auth. abst.)

3310. Ali, M. A. 1959. THE OCULAR STRUCTURE, RETINOMOTOR AND PHOTOBEHAVIORAL RESPONSES OF JUVENILE PACIFIC SALMON. *Canadian Journal of Zoology*, Vol. 37, No. 6, pp. 965-996.

A histological study of the eyes of juvenile sockeye, coho, pink, and chum salmon in fresh water shows that the cones and external nuclear and plexiform layers of the retinae of embryos and alevins are poorly differentiated and do not attain normal histological or physiological proportions under the emergence of fry from the gravel. From a histophysiological study it is evident that only the emerged fry and older stages are capable of retinomotor responses and that these responses become more marked with age. Differences in rates of adaptation are found among the species and stages. Generally, the pigment layer shows a latent period before contraction in dark. Sensitivity to light is independent of the complete light adaptation of the retinal pigment or visual cells, while full acuity of vision is dependent upon the complete light adaptation of cones. Threshold values of cones and rods are indicated by the feeding and schooling responses. At light intensities between the cone and rod thresholds the thickness of pigment and cone layers obey the Weber-Fechner law. There is no diurnal rhythm in the positions of retinal pigment and cones of juvenile *Oncorhynchus* either under constant light or dark. Results are discussed in relation to the migratory, schooling, and feeding behavior. The rapid downstream migration of juvenile salmon during a relatively short period in the night may be

related to a semi-dark-adapted state of the eye. (Auth. abst.)

3311. Hickman, Cleveland P., Jr. 1959. THE OSMOREGULATORY ROLE OF THE THYROID GLAND IN THE STARRY FLOUNDER, *PLATICHTHYS STELLATUS*. *Canadian Journal of Zoology*, Vol. 37, No. 6, pp. 997-1060.

Energy demands for osmotic regulation and the possible osmoregulatory role of the thyroid gland were investigated in the euryhaline starry flounder, *Platichthys stellatus*. Using a melting-point technique, it was established that flounder could regulate body fluid concentration independently of widely divergent environmental salinities. Small flounder experienced more rapid disturbances of body fluid concentration than large flounder after abrupt salinity alterations.

The standard metabolic rate of flounder adapted to fresh water was consistently and significantly less than that of marine flounder. In supernormal salinities standard metabolic rate was significantly greater than in normal sea water. These findings agree with the theory that energy demands for active electrolyte transport are greater in sea water than fresh water. Thyroid activity was studied in flounder adapted to fresh water and salt water. Percentage uptake of radioiodine by the thyroid was shown to be an insensitive and inaccurate criterion for evaluating thyroid activity in different salinities because removal rates of radioiodine from the body and blood differed between fresh water and marine flounder. Using thyroid clearance of radioiodine from the blood as a measure of activity, salt-water flounder were shown to have greater thyroid clearance rates and, hence, more active thyroid glands than flounder adapted to fresh water. The greater activity of the thyroid of marine flounder correlates with greater oxygen demands in sea water and suggests a direct or adjunctive osmoregulatory role of the thyroid gland of fish. (Auth. abst.)

3312. Gurvich, V. V., and Ya. Ya. Tseyeb. 1958. A MICROBENTHOMETER FOR THE QUANTITATIVE SAMPLING OF MICROBENTHOS. (MIKROBENTOMETR DLYA VZyatIYA KOLICHESTVENNYKH PROB MIKROBENTOSA.) *Dopovidi Akad. Nauk Ukrain. RSR* 1958(10): 1120-1123; *Biological Abstracts*, Vol. 35, No. 1, Abst. No. 107. 1960.

A device with the aid of which silt samples can be taken from the bottom of water reservoirs for counting benthonic microfauna was designed on the principle of taking monolithic samples, and represents an improved version of the Tseyeb tube. The main parts of the device are manufactured by the Leningrad "Gidrometprilad" plant. The functioning of this device is described, and how to operate it. (OTS)

3313. Dyk, V. 1957. THE MOST ELEVATED BROOK TROUT LOCALITIES IN CZECHOSLOVAKIA. (NEJVYŠŠÍ POLOHY VÝSKYTU PSTRUHA OBECNEHO FORMY POTOCNI V ČSR. (In Czech with German and Russian Summ.)) *Zool. Listy*, Vol. 20, No. 4, pp. 358-366; *Biological Abstracts*, Vol. 35, No. 1, Abst.

No. 472. 1960.

The brook trout, *Trutta trutta*, is a very adaptable fish in its ability to migrate to different elevations. In Czechoslovakia it migrates from places of about 200 m above sea level to regions 500-800 m above. Here it lays its eggs in the cold spring waters and here fishermen catch them. The highest Tatra mountain ranges reach altitudes of 1550 m above sea level, and in these regions trout have been spotted. In many brooks and lakes, trout are sought not only by fishermen, but also by otter, bear, and the black stork. In the neighboring Carpathian region, migrational patterns of the trout can be seen to change with storms, (which the trout can detect), and proceed to the ash regions. (MDS)

3314. Ives, K. J. 1959. THE SIGNIFICANCE OF SURFACE ELECTRIC CHARGE ON ALGAE IN WATER PURIFICATION. Jour. Biochem. and Microbiol. Technol. and Engineer., Vol. 1, No. 1, pp. 37-47; Biological Abstracts, Vol. 35, No. 1, Abst No. 2077. 1960.

The results of a study on the surface electric charge carried by fresh-water planktonic algae are used to provide a theory for the flocculation of algae with chemical coagulants. Where it is desirable to remove algae from water, for example from lakes or reservoirs for water supply, or from sewage oxidation ponds, the theory indicates certain practices are desirable to obtain the best removal. It is planned to extend the theory and experimental work to cover the removal of untreated algae from water by filtration through porous granular media, believed to be an adsorptive effect. Separation of different species of algae employing their electrokinetic properties is also described. (Auth. summ.)

3315. Branson, Branley A., and William R. Heard. SNAILS FROM UPPER PENINSULA OF ALASKA WITH FEEDING HABITS OF BROOKS LAKE FISHES. Nautilus, Vol. 73, No. 1, pp. 14-16; Biological Abstracts, Vol. 35, No. 2, Abst. No. 3417. 1960.

Six species of gastropods were collected from the edge and in periphyton of Brooks Lake. Three species of gastropods and one fingernail clam were found in fish stomachs. Mollusks provide much food of fishes studied. (R. W. D.)

3316. Reish, D. J., and J. L. Barnard. 1959. MARINE POLLUTION. Water and Sewage Works, Vol. 106, No. 6, pp. 259-262; Biological Abstracts, Vol. 35, No. 2, Abst. No. 3465. 1960.

The situation of marine pollution along the southern coast of California is discussed along with general oceanography and the various water uses. A decrease in value of fish landed in California of more than 50% since 1936 has been attributed to a depletion of the sardine population. A total of 3240 million gallons daily (m. g. d.) of wastes--domestic and industrial--are dumped into the ocean off southern California of which 800 m. g. d. is domestic waste. Over 90% of the industrial wastes are in the form of cooling water. Oil refinery wastes rank 2d in volume. Effects of these wastes on marine

life vary from destruction to enrichment and increasing of populations of marine organisms. Marine pollution studies have lagged behind freshwater studies. Tolerances of marine organisms to varying chemical and physical changes and relationship of pollution to food of marine life is little known. The State of California Water Pollution Control Board is supporting extensive research projects to determine present status of the marine environment and present pollutional effects which will provide valuable background information in the years ahead. (J. N. W.)

3317. Mordukhai-Boltovskoi, F. D. 1955. ON THE PROBLEM OF THE FORMATION OF BENTHOS IN LARGE RESERVOIRS ON THE MODEL OF THE (RYBINSKY) RESERVOIR. (K VOPROSU O FORMIROVANII BENTOSA V KRUPNYKH VODOKHRANILISHCHAKH (NA PRIMERE RYBINSKOGO VODOKHRANILISHCHA).) Zool. Shur., Vol. 34, No. 5, pp. 975-985; Biological Abstracts, Vol. 35, No. 2, Abst. No. 3483. 1960.

The process of fauna formation in certain reservoirs after the completion of the initial period in 5-10 years does not agree with the prognostications. This was demonstrated graphically in the example of the Rybinsky Reservoir, where the composition of the benthos from the boundaries of the riparian zone, in the 14th year of the existence of the reservoir, proved to be 10-15 times less than had been assumed. Dry-zone benthos, on the other hand, proved to be more abundant and different in its composition. Only estuary benthos correlated more or less with the forecast. The basic reasons for the inaccuracy of the predictions of the formation of the bottom fauna of the Rybinsky Reservoir were: (1) the false notion of the process of reservoir silting, which occurred irregularly: half-liquid mud formed from peat is accumulated principally in contour depressions; (2) the large dimensions of the reservoir, impeding the settling of Tenedipidae at a great distance from the shores; (3) a deficiency of food for benthic invertebrates; (4) underestimation of the reproductive capacities of the dry zone. In other reservoirs of the central and southern latitudes of the USSR, the benthos is richer than in the Rybinsky Reservoir, but relatively poor in comparison with the benthos of lakes.

3318. Serra, J. A. 1957. SCIENTIFIC PROBLEMS OF FISHERIES AND THEIR SOLUTION. (PROBLEMAS CIENTIFICOS DAS PESÇAS E SUA RESOLUCAO.) Rev. Portuguesa Zool. e Biol. Geral, Vol. 1, No. 1, pp. 33-87; Biological Abstracts, Vol. 35, No. 2, Abst. No. 3499. 1960.

Paper to be presented at the 5th National Congress of Fisheries. The importance of the production of fisheries for the protein part of the national diet is pointed out in comparison with other sources of proteins and the growth of the population. The gross efficiency of fisheries is considered and the probable causes of the lower values found in the last decade for which there are published statistics are discussed. Cycles of about 7-11 years are apparent and a regres-

sion line for the gradual increase of the total production of fishing, when it is abstracted from the cycles, has been calculated. Meanwhile, the total tonnage of the vessels employed has risen logarithmically, in order to obtain about the same amount of protein per capita of the population. The decline in general efficiency should be due to biological-ecological causes, which may be: a non-compensating increase in the level of predation, above the productivity of the species caught, that is, overfishing; and the existence of possible oscillations in the levels of reproduction and growth of the species to be fished, owing to changed oceanographic or biotic conditions. Oscillations may be centennial or macro-oscillations, some of them possibly irreversible and therefore not true or compensable oscillations; and short-term or microoscillations, called fluctuations, compensating within some years or a few decades. Recent examples of lower productivity imputed to physical factors are recalled. A discussion of the causes of a lower level of productivity should be based on a complete knowledge of the ecology of the species, or on detailed data concerning the age or size distribution within the populations found in the communities before and after, they are fished. A theoretical curve of constant mortality after the 1st ages and the consequences of fishing at a certain level are presented. Natality, mortality, emigration and immigration for a certain area are considered; compensation, and, therefore, no overfishing, may result from the interplay of the respective coefficients n' , m' , e' , i' . The chief physio-chemical and biotic factors which may influence the distribution in the populations are mentioned in relation to productivity. Generally, temperature and light are the chief limiting factors from the physical side, and salinity, N, and P (sometimes also Fe, Mn, Si, Ca and other elements or compounds) from the chemical one. Biotic factors may express themselves in the alimentary chain or by positive or negative conditioning, but physical and chemical factors, weather changes, sun cycles or other geological or astronomic causes may be responsible in the last analysis for the origin of cycles of fluctuation in the abundance or scarcity of the populations or of certain members of the communities. However, another source of fluctuations, independent of physical or chemical factors of the environment is pointed out, namely endogenous, biological causes such as: exhaustion of clones and their rejuvenation by sexual reproduction or hybridization; an exaggerated homozygosity in sexual species and their revigoration by hybridization heterosis; appearance of superior forms by mutations or hybridization, etc. The new or rejuvenated forms may exclude others and kill competing species, and a dislocation of the whole ecological balance may thus result. A third group of factors, to be considered when discussing the origin of fluctuations, are the ethological ones. Fishes, at least, have complicated ethological characteristics, more or less similar to those of other vertebrates, so called integrating behavioral principles of territoriality, dominance and hierarchy, and leadership being

easily recognized in schooling species and isolated individuals. Conditioning by secretions or excretions may be effective also at this level. Some observations on the behavior of fishes are recalled; an important one is that fishes are much more adaptable than it may be supposed by the general statistical ecologist, especially as regards their food habits. A section is dedicated to a brief discussion of the methods of improving, as against simply exploiting, the natural resources of fisheries: from simple fertilization with nitrates, phosphates, etc., to the active repopulation of some areas, rearing of broods, alevins and young fish selection (having in mind the possible existence of dominance effects or so-called size hierarchy), physiological treatments to improve growth, and active rearing in closed coastal waters. Problems raised by the increasing radioactive contamination of the sea are mentioned briefly. Problems arising from the deterioration and storage of fish catches are discussed. Physical, chemical and biological means for preserving fish in fresh conditions are mentioned and their potential use assessed. The national aspects of the organization for the solution of the most important scientific problems of fisheries are discussed. (Auth. summ.)

3319. Ward, F. J. 1959. CHARACTER OF THE MIGRATION OF PINK SALMON TO FRASER RIVER SPAWNING GROUNDS IN 1957. Bull. Internat. Pacific Salmon Fish. Comm. 10, pp. 1-70; Biological Abstracts, Vol. 35, No. 1, Abst. No. 3501. 1960.

The characteristics of the migration of pink salmon to the Fraser River system in 1957 are related, in this study, to the requirements of scientific management of the fisheries. Analysis of catch, tagging and escapement data indicated that populations of pink salmon spawning in particular streams, which are defined as races of pink salmon, could be classified into early and late migrating groups. It is suggested that fishing mortality rates affecting the early groups were greatest, particularly in Fraser River fishing areas. Pink salmon delayed off the mouth of the Fraser River for a considerable period but migration through the remaining fishing areas was rapid and direct. Two early migrating races moved directly to respective spawning areas but the two major late races delayed in the lower sections of their spawning streams for considerable periods. Although chronological order of migration was maintained from passage through Fraser River commercial areas until death, races which delayed lost chronology but regained it during residence on the spawning grounds. Total escapement of pink salmon to the Fraser River system was enumerated by the use of tagged individuals. The abundance of fish spawning in individual streams was estimated by a number of methods. Sources of error affecting each method are discussed. (Auth. abst.)

3320. Anonymous. 1957. THE ALL-UNION CONFERENCE ON AGRICULTURAL FISHING. Vestn. S-kh. Nauki 1957(5): 95; Biological Abstracts, Vol. 35, No. 3, Abst. No. 6216. 1960.

In the conference March 19-22 in Moscow, reports were heard concerning the status and the means

of further development of pond fishing on the collective farms of the USSR, methods of increasing productivity of pond fishing, also reports on the questions of feeding of fish, of pedigree work in pond economies, of trout breeding in collective farm reservoirs, on the means of combating fish diseases, on veterinary service, and other questions. (OTS-JPRS)

3321. Lutonskiy. 1956. ON THE METHOD OF BIOLOGICAL INVESTIGATION OF WATERS. *Ceskol. Hyg.*, Vol. 1, No. 3, pp. 157-159; *Biological Abstracts*, Vol. 35, No. 3, Abst. No. 6289. 1960.

A method of biological investigation of water in which organisms are counted by utilizing a Fooks-Rosental or Byurker counting camera is described. This method permits a more exact count than that obtained by counting on glass. (OTS-JPRS)

3322. Van Someren, Vernon D. 1959. A STUDY OF A SMALL BASKET-TRAP RIVER FISHERY IN KENYA. *East African Agric. Jour.*, Vol. 24, No. 4, pp. 257-267; *Biological Abstracts*, Vol. 35, No. 3, Abst. No. 2590. 1960.

Analysis of results of a 7 months operation of a small basket-trap fishery in the Ragati-Sagana river junction area (altitude of 3940 feet) indicated that such a fishery is relatively inefficient commercially but nevertheless can contribute materially toward alleviating protein malnutrition on an individual basis. Only 3 genera of fish enter such a fishery -- 2 species of *Anguilla*, and 1 each of *Barbus* and *Labeo*. Although total catch diminished during the period of study, this does not necessarily indicate a diminution of total stock, since these fish are migratory. The effect of fishing on total stocks is not clear although the fishery appeared to alter the composition of local fish stocks. Data available from the trap catches concerning migration, food, sex ratio, maturity state and length/weight relationship are discussed. (E. V. M.)

3323. Robertson, O. H., and Bernard C. Wexler. 1959. HYPERPLASIA OF THE ADRENAL CORTICAL TISSUE IN PACIFIC SALMON (GENUS *ONCORHYNCHUS*) AND RAINBOW TROUT (*SALMO GAIARDNERII*) ACCOMPANYING SEXUAL MATURATION AND SPAWNING. *Endocrinology*, Vol. 65, No. 2, pp. 225-238; *Biological Abstracts*, Vol. 35, No. 3, Abst. No. 7042. 1960.

A comparative study was made of the histological changes occurring in the adrenal cortical tissue of the Pacific salmon, the sea-run steelhead trout, and the non-migratory rainbow trout at various stages in their life cycles with the purpose of ascertaining whether there exists a relationship between degree of adrenal hyperplasia at spawning and survival thereafter. These three fishes show varying post-spawning outcomes from death of all the salmon to partial mortality in steelhead to usual survival of the rainbow trout. The adrenal cortical tissue, found in the cephalic end of the kidney, consists in the sexually immature fish of small isolated

groups of characteristic cells which are usually associated with branches of the cardinal vein. With the onset of gonadal development the adrenal cells begin to increase in number and by the time sexual maturity is reached in the salmon and steelhead, marked hyperplasia is present. The cells of this hyperplastic tissue are larger than those in the immature fish and are uniform in size and appearance. In the spawning fish degeneration of the adrenal cells is evident--this is more marked in the salmon than in the steelhead trout--many of which show no degenerative change. In contrast to the salmon and steelhead, hyperplasia of the adrenal tissue in the non-migratory rainbow trout is very much less pronounced. The various factors which might operate to induce adrenal hyperplasia are discussed. (Auth. abst.)

3324. Fontaine, M., and J. Leloup-Hatey. 1959. THE ASCORBIC ACID IN THE PITUITARY OF THE ADULT SALMON. (*L'ASCORBIE HYPOPHYSIAIRE DU SAUMON ADULTE (SALMO SALAR L.)*) *Bull. Inst. Oceanogr. (Monaco)* 1135. 1-8; *Biological Abstracts*, Vol. 35, No. 3, Abst. No. 7099. 1960

During anadromous migration, the salmon pituitary gland becomes poorer in ascorbic acid, more so in the female than in the male. The ponderal importance of the female genital products and their richness in vitamin C explain, at least partly, this sex difference. Nevertheless, the decrease of the content in ascorbic acid of the gland can be explained as the indication of an intense secretory activity, for an hypertrophy is also noticed. This hyperactivity can thus be explained: the pituitary gland, during anadromous migration, secretes the gonadotropins required for the maturation of gonads and simultaneously the various tropins which, through their direct or indirect action on the tissular reserves, will enable the salmon to cover the large energetic expenses involved in the ascent of river currents and spawning. (Auth. summ.)

3325. Woodhead, A. D., and Y. A. Fontaine. 1959. SOME DATA ON THE THYROTROPIC POTENCY OF THE HYPOPHYSIS OF THE RAINBOW TROUT. (QUELQUES DONNEES SUR LE POUVOIR THYROTROPE DE L'HYPHYPHYSE DE LA MORUE (*GADUS MORRHUA* L.)) *Bull. Inst. Oceanogr. (Monaco)* 1137. 1-6; *Biological Abstracts*, Vol. 35, No. 3, Abst. No. 7148. 1960.

The influence of cod's pituitary extracts on the uptake of I^{131} by the thyroid of the rainbow trout has been studied and the thyrotropic activity of these pituitaries measured by this method. This activity is about 6 milliunits USP per mg of dry pituitary and does not seem to vary much during the biological cycle of this species. (Auth. summ.)

3326. Rossmann, Angela. 1959. ON COUNTING ABILITY IN FISH. (UBER DAS ZAHL VERMOGEN DER FISCHE. *Zeitschr. Tierpsychol.*, Vol. 16, No. 1, pp. 1-18; *Biological Abstracts*, Vol. 35, No. 4, Abst. No. 9400. 1960.

Simultaneous and successive discriminations of

numbers were required of minnows (*Phoxinus laevis*), rudds (*Scardinius erythrophthalmus*), sticklebacks (*Gasterosteus aculeatus*), bullheads (*Ameiurus nebulosus*) and chubs (*Squalius cephalus*). In free choices a larger number was discriminated from a smaller number. Training led to some improvement in simultaneous judgments of "more" or "less", but not of specific numbers. Successive discrimination could be made only to the first as against subsequent stimuli. Counting ability in fish could not be proven. (H. E. A.)

3327. Schulte, Arnhilt. 1957. TRANSFER AND TRANSPOSITION EXPERIMENTS WITH MONOCULARLY TRAINED FISH. (TRANSFER UND TRANSPOSITIONSVERSUCHE MIT MONOKULAR DRESIERTEN FISCHEN.) Zeitschr. Vergl. Physiol., Vol. 39, No. 4, pp. 432-476; Biological Abstracts, Vol. 35, No. 4, Abst. No. 9402. 1960.

Fifty-five crucian carp (*Carassius vulgaris*) were trained monocularly to differentiate between figures (e.g., vertical vs. horizontal stripes) in alternative choice without punishment, then were tested as to what extent the learned figure, as well as its transpositions, could be recognized with the opposite, untrained eye. Of 21 carp tested, 18 recognized the training figure with the untrained eye. A total of 23 carp were tested for interocular transference by offering a transposed sign. A transfer occurred only if the modification of the sign was insignificant. In re-training, the 2 fish tested could not be trained with the left eye on a positive and the right eye on a negative of the same image. However, no change of the trained eye occurred with regard to the new habit. Both animals declined, rather, when the trained eye was tested for vertical steadiness. The ability of binocular control fish to transpose was higher than that of most of the monocular animals. In binocular control fish both the positive and negative model of a pair of signs could provide a basis for training. In memory tests the monocular fish tested were not significantly different than the binocular animals. Recall was not distinctly better in the use of the trained eye than in the use of the untrained transfer eye. Animals of which too much had been demanded displayed a distinct nervousness suggesting neurosis in conflict situations. The transfer and transposition findings tend to support the hypothesis that there is an unequal distribution of the hemispheres in the learning process. The primary and more strongly stimulated hemisphere permits a recognition of transposition which the secondarily stimulated hemisphere misses. The greater capacity for learning and transposition of binocular control fish suggests that a relationship between the neural efficiency and the more actively participating portion of the brain in the learning process is significant in the sense of LASHLEY's "mass rule." (MDS)

3328. Mushenko, V. G. 1956. THE EFFECT OF SPRING FLOOD CURRENTS OF FORMATION OF SOILS AND ZOOBENTHOS IN LAKE BOTTOM

LAND. Sbornik Nauchn. -Issled. Rabot Azovo-Chernomorsk. S. -kh. Inst. 1956(14): 173-183; Biological Abstracts, Vol. 35, No. 4, Abst. No. 9525. 1960.

The formation of bottom soils, the quantitative changes and territorial shifts of different groups of zoobenthos in Lake Derganovo (Don-Aksay bottom land) under the influence of flood currents. (OTS-JPRS)

3329. Platonova, L. V. 1956. FAUNA AND PRODUCTIVITY OF LAKE SHIRA. Trudy Tomskogo Univ. 1956 (143): 65-72; Biological Abstracts, Vol. 35, No. 4, Abst. No. 9526. 1960.

The lake is 9 km long, the widest point 5.5 km, surface area 31 km², greatest depth 21 m, average depth 6.5 m. Surface temperature ranges from -0.6° in Jan. to 20.3° in Aug. During winter the waters deeper than 10 m are warmer than the surface waters. The average salinity is 14 g/l. Sulfate salts predominate. Down to a depth of 11-12 m the content of O₂ is absent. Hydrogen sulfide in Lake Shira is formed evidently by reduction of sulfates with the aid of bacteria of the microspira type. Poor quality of vegetable and animal plankton is noted. Twenty-four species of phytoplankton and 19 of zooplankton are recorded. Four biologic seasons are distinguished. A marked diminution of zooplankton is noted at a depth of 10 m. The whole area of the lake bottom is divided into 2 zones: a productive one (to a depth of 10-13 m) and a non-productive one (13-31 m). The chief mass of zoobenthos consists of tendipedids; their maximum development in July is 74.74 g/m². Gammarus is in 2d place as to biomass (biomass in July 5.13 gm/m²). Lake Shira differs greatly from investigated salt lakes by absence of corrosion; the organic substances are almost fully mineralized, producing a valuable hydrogen sulfide silt.

3330. Mil'shtein, V. V. 1957. THE USE OF FERTILIZERS ON SPAWNING AND REARING FARMS. (PRIMENENIYE UDOBRENIY V NERESTOVOVYROS-TNYKH KHOZYAYSTVAKH.) Trudy Probl. i Temat. Soveshchaniy Zool. Inst. Akad. Nauk SSSR 1957(7): 73-77; Biological Abstracts, Vol. 35, No. 4, Abst. No. 9552. 1960.

At the spawning and rearing farm "Batrachok" (in the Volga River delta) superphosphate was applied twice - 10 days before filling the lake, and after the admission of water; this increased the productivity of the fish on the farm by 35.8 kg/ha, or 22% over the average fish production of the North Caspian State Fish Farm. Good results also have been obtained using mowings and similar substances on floats of reed mace, sedge and canes as organic reservoir fertilizers. (OTS-JPRS)

3331. Dubale, M. S. 1959. A COMPARATIVE STUDY OF THE OXYGEN-CARRYING CAPACITY OF THE BLOOD IN WATER- AND AIR-BREATHING TELEOSTS. Jour. Animal Morphol. and Physiol., Vol. 6, No. 1, pp. 48-54; Biological Abstracts, Vol. 35, No. 4, Abst. No. 9987. 1960.

The O₂-carrying capacity of blood in 10 water- and air-breathing teleosts was estimated in terms of blood Fe concentration. Fe varied from 15-27 mg-27 mg/100 cc in water-breathers and from 29-40 mg/100 cc in air breathers, indicating that the loading tension of O₂ in the blood of air-breathers is higher than that in water-breathers. It is suggested that the acquisition of the air-breathing habit is closely correlated with the O₂-fixing capacity of the blood. (MDS)

3332. Idler, D. R., A. P. Ronald, and P. J. Schmidt. 1959. BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION. VII. STEROID HORMONES IN PLASMA. Canadian Jour. Biochem. and Physiol., Vol. 37, No. 10, pp. 1227-1238; Biological Abstracts, Vol. 35, No. 4, Abst. No. 10122. 1960.

Cortisone, cortisol, and 17-hydroxyprogesterone were isolated from the plasma of prespawning Fraser River sockeye salmon. The female plasma contained double the concentration of cortisone and cortisol found in male plasma, 41 µg and 26 µg/100/ml respectively as compared with 22 µg and 11 µg/100 ml. Corticosterone is probably present at a very low concentration and neither 11-desoxycorticosterone nor aldosterone was detected in the plasma from approximately 100 fish. Cortisone, cortisol, and total 17-hydroxysteroids were quantitatively determined in plasma samples obtained from two pure races of sockeye captured at various stages of sexual maturity. The combined concentration of cortisone and cortisol which at the mouth of the river was three times that of the normal human, increased to as high as 17 times this level following spawning. The results are discussed in relation to the death of the fish. (Auth. abst.)

3333. Davis, Percival W., Jr. 1959. THE YELLOW BODIES OF THE CHONDROSTEAN FISH, POLYDON SPATHULA. Bios, Vol. 30, No. 3, pp. 155-158; Biological Abstracts, Vol. 35, No. 4, Abst. No. 10640. 1960.

The spoon bill, *P. spathula*, is a primitive fish with its structure similar to that of the Chondrichthyes. The cartilaginous rostrum is covered by what appears to be a network consisting of extensive ramifications of the lateral line canals which are innervated by the ramus maxillaris of the 5th cranial nerve. This ramus also innervates a mass of yellow tissue found embedded within the cartilage at the base of the rostrum, at the posterior end of a long canal which transverses along the entire length of the structure. A series of 5 pairs of major and a few minor cavities exist on both sides of the skull of the fish which are filled with a yellow spongy tissue consisting of medullary and cortical portions. These yellow bodies are all innervated by branches of the trigeminal nerve. Other collections of yellow tissue are found along the backbone. Though these yellow bodies are composed largely of lipids, they are probably not storage depots for fats. Various theories concerning the

function of the yellow bodies are presented. (MDS)

3334. Tampi, P. R. S. 1959. ON THE RENAL UNIT IN SOME COMMON TELEOSTS. Proc. Indian Acad. Sci. Sect. B., Vol. 50, No. 2, pp. 88-104; Biological Abstracts, Vol. 35, No. 4, Abst. No. 10649. 1960.

The general histology of the renal units of 20 selected species of teleosts has been given. Besides an analysis of the glomerular size in a total of 43 species of fish shows good agreement with some of the well-known theories of glomerular development in relation to habitat. This preliminary study has helped to bring out some of the essential lines on which reliable data on renal physiology of some euryhaline fishes have to be obtained and these are briefly discussed. (Auth. summ.)

3335. Gehringer, Jack W. 1958(1959). LEPTOCEPHALUS OF THE ATLANTIC TARPON, *MEGALOPS ATLANTICUS VALENCIENNES*, FROM OFF SHORE WATERS. Quart. Jour. Florida Acad. Sci., Vol. 21, No. 4, pp. 235-240; Biological Abstracts, Vol. 35, No. 4, Abst. No. 11923. 1960.

A single leptocephaliid larva of the Atlantic tarpon, *Megalops atlanticus Valenciennes*, was taken during cruises of the M/V *Theodore N. Gill* off the south Atlantic coast of the United States during 1953-1954. Taken in a plankton tow well out in the Gulf Stream at 31°30'N. lat., 78°42'W. long., about 150 miles east of Brunswick, Georgia, August 5, 1953, this 18-mm (standard length) leptocephalus, representing a heretofore undescribed stage of development for the tarpon, is described, figured, and compared with the closely-related East Indian tarpon, *M. cyprinoides* (Broussonet); the bonefish, *Albula vulpes* (Linnaeus); and the ten-pounder, *Elops saurus* Linnaeus. (Auth. summ.)

3336. Swarup, H. 1957. APPARATUS FOR REARING EARLY STAGES OF FISH. Jour. Univ. Sagar 6: 99-100; Biological Abstracts, Vol. 35, No. 5, Abst. No. 12060. 1960.

The apparatus consists of 24 egg containers, a deep tray and a system of water jets; each egg container being made up of a pair of glass tubes, one inside the other. A continuous current of water is thus possible over the eggs kept in the inner tube of the egg container and helps in raising a good percentage of embryos. (Auth. abst.)

3337. Myers, G. S. 1958. TRENDS IN THE EVOLUTION OF THE TELEOSTEAN FISHES. Stanford Ichthyol. Bull., Vol. 7, No. 3, pp. 27-30; Biological Abstracts, Vol. 35, No. 5, Abst. No. 12081. 1960.

Trends from the generalized to the more specialized characters are noted for the Cyprinodontidae and Characidae towards loss or simplification of jaw bones, teeth and pseudobranchiae. A somewhat similar trend is noted for the teleostean families which run to minute size, where reduction in number of scales, number of fin rays, simplification of dentition, and suppression of the lateral line system takes

place. A short discussion of the evolution of the teleost suspensorium is given. (A. D. W.)

3338. Bird, Charles D. 1959. A TECHNIQUE FOR DETERMINING RELATIVE ABUNDANCE AND DISTRIBUTION OF AQUATIC PLANTS. Proc. Oklahoma Acad. Sci. 39:5; Biological Abstracts, Vol. 35, No. 5, Abst. No. 12376. 1960.

A means of measuring aquatic vegetation by pacing the shoreline and, at specific intervals, stopping and recording all vascular plants visible in the water at right angles to the shore. The system is compared with others and advantages and drawbacks discussed. (Auth. abst.)

3339. Chatwin, B. M. 1967. FURTHER RESULTS FROM TAGGING EXPERIMENTS ON LINGCOD. Fish. Res. Bd. Canada Pacific Progr. Repts. 107: 19-21; Biological Abstracts, Vol. 35, No. 5, Abst. No. 12426. 1960.

Recoveries not previously recorded of 419 tags put on lingcod, *Ophiodon elongatus*, in the Strait of Georgia and off the west coast of Vancouver Island show relatively few (less than 23%) long movements, in some cases even after several years. Large (mostly female) fish were most sedentary, favoring rocky banks. This probably accounts for the tendency of fish caught by handliners tagged and released over rough bottom to be caught again by handliners, and for the smaller fish caught by trawls and tagged to be returned by trawlers. There is some (inconclusive) evidence of homing from an accidental transplanting experiment. (J. L. H.)

3340. Houser, Alfred. 1959. FISH POPULATION ESTIMATES IN CRYSTAL LAKE, CLEVELAND COUNTY, OKLAHOMA. Proc. Oklahoma Acad. Sci. 39: 191-195; Biological Abstracts, Vol. 35, No. 5, Abst. No. 12430. 1960.

Fish population estimates were made by the indirect method of marking and recapturing fish for a 26-acre lake near Norman, Oklahoma. Two methods were used to calculate the population size in the fall of 1959 and again in the spring of 1958. Employing estimates having the greatest efficiency according to the ratio of the number of marked fish to the estimated population size as suggested by Ricker, the results are compared. Differences between estimates for the 2 periods are attributed to recruitment and natural mortality. (Auth. abst.)

3341. Webbe, G., and G. T. Shute. A FURTHER NOTE ON THE ACTION ON FISH OF CHLORINATED HYDROCARBONS WHEN USED AS LARVICIDES. Ann. Trop. Med. and Parasitol. 53 (1): 47-50; Biological Abstracts, Vol. 35, No. 5, Abst. No. 12443. 1960.

Five percent D. D. T., 3% gamma-BHC, 2 1/2% aldrin, 2 1/2% dieldrin dusts and 2% dieldrin granules caused no mortality in 3 species of *Tilapia* (*melanopleura*, *macrochir* and *pangani*) when applied for 20 weeks at 1 lb./acre/week. Breeding, growth and taste were unaffected. Aldrin dust applied weekly at 5 lb. and 10 lb./acre for 3 weeks

caused a mortality of 3.3% (*macrochir* only) and 60% (*macrochir* 80%, *melanopleura* 80%, *pangani* 20%) respectively. Dieldrin dust under similar conditions caused a mortality of 6.6% (*macrochir* only) and 66.6%, (*melanopleura* 100%, *macrochir* 70% and *pangani* 30%) respectively. (B. McM.)

3342. DeLong, Donald C., John E. Halver, and Edwin T. Mertz. 1959. NUTRITION OF SALMONOID FISHES. VII. NITROGEN SUPPLEMENTS FOR CHINOOK SALMON DIETS. Jour. Nutrition 68(4): 663-669; Biological Abstracts, Vol. 35, No. 5, Abst. No. 12600. 1960.

The efficiency of L-arginine · HCl, glycine, urea, and diammonium citrate as supplementary N in chinook salmon diets was studied. Six lots of 200 fish each, average weight 3.8 g, were used. Diets containing 20% balanced protein and 40% balanced protein were compared with diets containing 20% balanced protein and 20% "crude" protein as L-arginine · HCl, glycine, urea or diammonium citrate. Chinook salmon were apparently like other animals in their ability to convert arginine and glycine to non-essential amino acids, but, in contrast, seemed unable to convert urea or diammonium citrate to these compounds for growth. (Auth. summ.)

3343. Schoen, Lore. 1957. MICRO VARIATIONS OF SOME CENTRAL VESTIBULAR NEURONS OF THE TELEOSTAE WITH STIMULATION OF THE STATOLITHS. (MIKROABLEITUNGEN EINZELNER ZENTRALER VESTIBULARNEURONE VON KNOCHENFISCHEN BEI STATOLITHENREIZEN. Zeitschr. Vergl. Physiol., Vol. 39, No. 4, pp. 399-417; Biological Abstracts, Vol. 35, No. 5, Abst. No. 13161. 1960.

Individual neuron discharges were recorded from the medulla oblongata and the valvula cerebelli of narcotized Teleostae (including 47 *Tinca vulgaris*, 1 goldfish, 5 *Esox lucius* and 3 *Amiurus nebulosus*) with wire electrodes when the statoliths were stimulated. Specific reactions of the neurons were observed when the animals were tilted sideways around their longitudinal axis. The regular discharge of the neurons when the fish is in its normal position shows a continuous rise in frequency with the angle of tilting in one direction. In the opposite direction a decrease in frequency occurs. Every position of the fish is co-ordinated with a specific frequency which sets in immediately and remains unchanged for several seconds. If the frequency values of a neuron are presented as a function of the angle of tilting, then 4 types of reactions may be differentiated, according to their course. (1) The change in frequency is continuous in the total range of tilting angles from 180° and sine-shaped in its ideal form. A linear relationship exists between stimulation (shearing of the statoliths) and excitation. (2) The course of the curve is significantly steeper in one direction of tilting than in the other, in which it gradually approaches a final value. (3) The activity at rest remains unchanged when tilted in one direction, while in the other it rises or falls with the angle of tilting. Perhaps these neurons have a stabilizing function similar to the A-neu-

rons of the optical cortex. (4) A portion of the neurons attain a frequency of 0 on the other side of the normal position after a steep progression in frequency to the activated side. Several are even unresponsive in the normal position. Some neurons show additional acceleration reactions when the angle of tilting is changed. These can probably give alarm signals regarding a change in position, coordinated with responses of the semi-circular canals. The excitation level can fall or rise if kept long in one position, according to the extreme positions previously traversed. However, adaptation to the frequency at rest does not occur. A frequency gradient related to the angle of tilting is always present. If the initial frequency is changed in the course of a discharge, then the curves showing the relationship between frequency and angle of tilting shift almost parallel to one another. The course which the frequency takes is therefore a characteristic property of every neuron. Some neurons have a delayed reaction of several seconds to the tilting angle, and less clear changes in frequency. This may possibly be due to elements of a higher plane of coordination (regulation of the eye or body position?). The relationship of the central vestibular neurons to the discharges of the sensory cells and to the behavior of the animal are discussed along with the significance for central coordination and the excitation equilibrium of the central nervous system. (MDS)

3344. Wohlfahrt, Theodor A. 1957. EXPERIMENTS ON THE ABSOLUTE DIFFERENTIATION OF TWO SOUNDS WITH THE SAME FREQUENCY RELATIONSHIP BY MINNOWS. (*PHOXINUS LAEVIS* AGASS.) (VERSUCHE ZUR ABSOLUTEN UNTERSCHIEDUNG VON ZWEIKLANGEN MIT GLEICHEM FREQUENZVERHALTNIS DURCH ELRITZEN. (*PHOXINUS LAEVIS* AGASS).) Zeitschr. Vergl. Physiol., Vol. 39, No. 4, pp. 418-431; Biological Abstracts, Vol. 35, No. 5, Abst. No. 13172. 1960.

Two minnows were trained by means of differential dresseur to 2 sounds (minor thirds). The feeding signal $d^1 r^1$ remained always constant, the opposing signal initially had a large difference in frequency and then gradually approached that of the feeding signal until they might be confused with one another. The experimental fish were studied for their absolute ability to differentiate between tones. One minnow differentiated certain thirds without the use of a special punishment stimulus. The other was able with reprimanding to distinguish other thirds. The course of the experiments confirms the hypothesis that the threshold of differentiation has not yet reached. The differentiation of thirds exceeds the average capacity of minnows in the absolute differentiation of individual tones. When the tone d^1 (the deeper tone of the third in the feeding signal) was offered alone, one fish showed no searching reaction and the other did not react in the beginning. For the experimental animals trained to two sounds apparently one tone has distinctly different tone qualities. The octave $d^1 d^2$ was answered as d^1 owing to interval merging. On the other hand, the

fifth $d^1 a^1$ resulted in a searching reaction. (MDS)

3345. Heard, William R., and Milton R. Curd. 1959. STOMACH CONTENTS OF AMERICAN MERGANSERS, *MERGUS MERGANSER* LINNAEUS, CAUGHT IN GILL NETS SET IN LAKE CARL, BLACKWELL, OKLAHOMA. Proc. Oklahoma Acad. Sci. 39: 197-200; Biological Abstracts, Vol. 35, No. 6, Abst. No. 14871. 1960.

Macroscopic examination of gross stomach-contents of 89 American mergansers revealed that 81% of their diet was composed of rough or forage fishes in a central Oklahoma reservoir. A total of 304 fishes comprising 4 identifiable species and a piece of elasmobranch skin was taken from 45 stomachs. Remaining stomachs were empty or contained digestive resistant otoliths. Recovery of these ducks from 35 feet of turbid water suggests perception of fish by some means other than sight, perhaps hypersensitivity to motion in water. Feeding of this bird in region should be more beneficial than detrimental. (Auth. abst.)

3346. Heard, William R. 1959. COTTON RATS, *SIGMODON HISPIDUS*, AS FOOD OF CHANNEL CATFISH, *ICTALURUS PUNCTATUS*. Proc. Oklahoma Acad. Sci. 39: 200-201; Biological Abstracts, Vol. 35, No. 6, Abst. No. 14872. 1960.

Examination of 21 channel catfish taken in gill nets indicated that 33% had eaten at least 1 cotton rat. Two additional incidents of channel catfish eating cotton rats are reported. (Auth.)

3347. Stohler, Rudolf. 1959. THE RED TIDE OF 1958 AT ENSENADA, BAJA CALIFORNIA, MEXICO. Veliger, Vol. 2, No. 1, pp. 32-35; Biological Abstracts, Vol. 35, No. 6, Abst. No. 14898. 1960.

The death of large numbers of various species of gastropods and pelecypods in the Estero de Punta Banda just south of Ensenada is attributed to the depletion of O_2 in the H_2O due to increase in temperature and fouling of the water; the organism responsible for the phenomenon was found to be the dinoflagellate *Gonyaulax polyedra* which occurred in great density, up to 15,414 organisms/cc of sea water. The species affected are listed and graphs illustrate temperature clines in various areas, salinity, and density of organisms at several stations. (Auth.)

3348. Savitskiy, A. G. 1958. BUILDING AND OPERATIONAL EXPERIENCE WITH SIMPLIFIED SPILLWAYS. (IZ OPYTA STROITEL'STVA I EKSPLOATATSII UPROSHCHENNYKH VODOSLIVOV.) Meteorol. i Gidrol. 1958(10): 48-49; Biological Abstracts, Vol. 35, No. 6, Abst. No. 14907. 1960.

In the Belorussian SSR, the flow-off from small drainage areas is being studied for many brooks and rivers. At such stagnation points, measurement of water consumption by a vane water meter is impeded due to small depths or velocities which about equal the initial velocity of the vane water meter. The calculation of the flow-off with the required accuracy is often not secured by the measurement of a small water consumption. As the erection of stable concrete water

discharges for studying the flow-off of brooks would be time-consuming and expensive, the Hidrologicheskaya stantsiya Minsk (Hydrological Station Minsk) developed a so-called simplified discharge and introduced it in several rivers. This water discharge consists of a bung frame and a detachable shield. In the middle of the upper edge, the frame has a cutout about as wide as the river bed, and lets high-water masses through. After their drainage, the shield consisting of metal (sheet iron 3 mm) or light sawn timber is inserted into the cutout. With the use of wood, edges etc. can be reinforced with metal. The insertion point between frame and shield is sealed with rubber or the like. According to the flow intensity and the passage capacity, the shield may have a triangular or trapezoidal cutout. The water discharge is best fitted at a low water level, the shield is removed in high water. Above the water discharge in the river bed, earth dams are erected and the water is let through an escape channel. The water between dams is pumped off. The frame is sealed with kneaded loam in a pit 1.5 m deep, and secured against erosion. The river bed and the new reservoir are cleared of shrubs. Above the water discharge a pile is set into the basin. This pile is adjusted by means of leveling to the edge of the water discharge. The observations, and the determination of the water consumption, are made daily on this pile at 0800 and 2000 hours. The water plants in the reservoir should be mowed in summer. (OTS)

3349. Nickel, Elvira. 1957. COMPARATIVE EXPERIMENTAL INVESTIGATIONS CONCERNING THE METABOLISM OF LIVING, ISOLATED GILL TISSUE OF THE RAINBOW TROUT (TRUTTA IRIDEA W. GIBB) AND THE CHUB (SQUALUS CEPHALUS L.). (VERGLEICHEND EXPERIMENTELLE UNTERSUCHUNGEN UBER DEN STOFFWECHSEL DES ISOLIERTEN LEBENDEN KIEMENGEWEBES VON REGENBOGENFORELLE (TRUTTA IRIDEA W. GIBB.) UND DOBEL (SQUALUS CEPHALUS L.)) Zeitschr. Vergl. Physiol., Vol. 40, No. 1, pp. 42-64; Biological Abstracts, Vol. 35, No. 6, Abst. No. 15385. 1960.

The respiration of gill tissue of the stenothermic trout and the eurythermic chub were determined in a temperature range from 5-20°C. The O₂ uptake of trout gills was considerably higher than that for the chub at all temperatures. The tissue metabolism of the eurythermic species is "relatively thermostable", that is, it is less influenced by temperature than the stenothermic species. The O₂ uptake of the tissues of both species is influenced by a seasonal regulation mechanism. In the summer months the relationship of respiration to the temperature follows an exponential function with rising Q₁₀ values. In winter the Q₁₀ value decreases with an increase in temperature. O₂ uptake is somewhat higher in the winter than in the summer. The O₂ uptake curves of the gill lamellae of both species are completely identical at sudden changes of temperature apart from quantitative differences. The percent of increase or decrease in the O₂ uptake depends upon

the initial level of metabolism. The velocity of metabolic change brought about by a change in temperature is the same for both species with only insignificant differences. The upper limit of thermal tolerance is 30°C for trout gills and 35°C for chub gills. KCN affects the O₂ uptake of trout gills more markedly than chub gills. The residual respiration of trout tissues is between 4.3 and 11.9% of normal, while that of chub tissue is between 13.5 and 19.5%. The portion of cyanide-sensitive and cyanide-resistant respiratory system is different for these 2 species. The tissue of the eurythermic fish shows a greater resistance to p-benzoquinone than the tissue of the stenothermic animal. At the temperatures investigated anaerobic glycolysis is quantitatively higher in trout gills than in chub gills. However, if the glycolysis is computed as a percent of the O₂ uptake at the same temperature, then at 15 and 20°C chub tissue shows a relatively greater ability for anaerobic hydrolysis processes. In summer anaerobic glycolysis is less than in winter for both species. By the addition of Thyroxin (Roche) to the respiratory medium no effect on the tissue metabolism of either species was noted at concentrations of 10⁻⁸ or 10⁻¹⁶, which others report to be optimum for increasing it. An inhibition of approximately 19% of the normal consumption was observed at a concentration of 10⁻⁴. In a medium rich in Ca and Mg the O₂ uptake of trout gills decreased and the resistance to poison was thereby increased. With chub tissue the addition of KCl produced the opposite effect. Metabolic measurements on isolated tissue of trout and chub, parallel the observations of previous authors on complete animals. The different behavior of stenothermic and eurythermic animals is based in part on the different tissue metabolism. It is suggested that differences in the plasmatic cell structure, in water content, and in enzyme concentration explain differences between these two species in tissue metabolism. (MDS)

3350. Grant, William C., Jr., and Grace E. Pickford. 1959. PRESENCE OF THE RED EFT WATER-DRIVE FACTOR PROLACTIN IN THE PITUITARIES OF TELEOSTS. Biol. Bull, Vol. 116, No. 3, pp. 429-435; Biological Abstracts, Vol. 35, No. 6, Abst. No. 15567. 1960.

The active factor which induces the terrestrial (red eft) phase of Diemyctylus viridescens to enter water in prolactin. The red eft water-drive test indicates that a prolactin-like hormone is present in the hypothysis of teleostean fishes. Pituitary extracts of late spawning carp (Cyprinus carpio) and pre- or post-spawning Fundulus heteroclitus gave a positive response. Pollack (Pollachius virens) pituitary brei from pre-spawning fishes gave only a weak response, and negative results were obtained with Fundulus pituitary glands from fish at the beginning of the spawning season. Although confirmation is needed, these data suggest a possible period of depletion during the early spawning phase of the sexual cycle. The experiments also demonstrated that the pituitary of the species investigated contains a growth promoting factor and a molting hormone. (Auth. abst.)

3351. Kosto, Bernard, Grace E. Pickford, and Morris Foster. 1959. FURTHER STUDIES OF THE HORMONAL INDUCTION OF MELANOGENESIS IN THE KILLIFISH, *FUNDULUS HETEROCLITUS*. *Endocrinology*, Vol. 65, No. 6, pp. 869-881; *Biological Abstracts*, Vol. 35, No. 6, Abst. No. 15578, 1960.

New experiments confirm the respective roles of prolactin and intermedin in the in vivo melanin pigmentation of *Fundulus heteroclitus*: prolactin promotes melanin synthesis, intermedin stimulates proliferation of melanocytes. Prolactin potentiates the response to intermedin, but intermedin has no reciprocal influence on the response to prolactin. Treatment with alkali enhances the activity of intermedin about tenfold. The response to alkali-treated intermedin increases in proportion to the dose. The slight melanocyte stimulating action of ACTH, which is potentiated by prolactin, is concordant with its inherent MSH-like activity. In vitro studies of fin samples incubated with dopa indicate a significant correlation between O₂ consumption and degree of darkening. After hypophysectomy, which leads to progressive in vivo depigmentation, dopa tyrosinase activity declined. Enzyme activity was restored, to a greater or lesser extent, by chronic administration of any of the 3 hormones under investigation: prolactin, intermedin, and ACTH. Only prolactin restored in vivo melanin pigmentation, possibly by increasing the supply of endogenous precursor. Since new pigment cells are being formed, the stimulating action of intermedin on the enzyme system may be different from that of prolactin in which only an intracellular increase in already existing cells can be postulated. The influence of prolactin in potentiating the response to intermedin may be correlated with its hypothetical action on chromagen precursor. ACTH appears to stimulate both dopa tyrosinase and also a non-tyrosinase oxidative enzyme system. (Auth: abst.)

3352. Sundararaj, B. I. 1959. A STUDY ON THE CORRELATION BETWEEN THE STRUCTURE OF THE PITUITARY GLAND OF THE INDIAN CATFISH *HETEROPNEUSTES* AND THE SEASONAL CHANGES IN THE OVARY. *Acta Anat.*, 37(1/2): 47-80; *Biological Abstracts*, Vol. 35, No. 6, Abst. No. 15600, 1960.

In the prespawning period the hypophyseal basophils show degranulation and granulation. In the spawning period, most are granulated. Degranulation proceeds during the postspawning period. Spawning is brought about by the degranulation of the few basophils secreting LH. Most basophils secrete FSH. The basophils developed in one season control ovulation in that season and development and growth of the oocytes of the next season. Fluctuation of the acidophils seems to be associated with secretion of non-gonadotropic hormones. (A.E.W.)

3353. Myers, George S. 1958. NOMENCLATURE OF CERTAIN TERMS USED FOR HIGHER CATEGORIES OF FISHES. *Stanford Ichthyol. Bull.*, Vol. 7, No. 3, pp. 31-40; *Biological Abstracts*, Vol. 35,

No. 6, Abst. No. 17630, 1960.

A list of the terms applied to the higher groups of fishes accompanied by notes tracing the usage of the terms. (A.D.W.)

3354. Ross, Robert D. 1959. A KEY TO THE FISHES OF THE SHENANDOAH RIVER SYSTEM IN VIRGINIA. *Virginia Agric. Expt. Sta. Tech. Bull.* 142. 1-14; *Biological Abstracts*, Vol. 35, No. 6, Abst. No. 17634.

3355. Scott, W. B., and E. J. Crossman. 1959. THE FRESHWATER FISHES OF NEW BRUNSWICK; A CHECKLIST WITH DISTRIBUTIONAL NOTES. *Roy. Ontario Mus. Zool. and Paleontol. Contr.* 51: 1-45; *Biological Abstracts*, Vol. 35, No. 6, Abst. No. 17635.

No comprehensive work on the freshwater fish fauna of New Brunswick has appeared since the 1896-1900 period, when a catalogue was published by Dr. Philip Cox, and some of the data contained in this concerning localities and range had been quoted from a catalogue published in 1852. The purpose of the present paper, therefore, is to draw together all the currently available data, in order that the need for an ichthyological study may be emphasized, and to provide a basis for such further study. The annotated list of spp. contains the anadromous and catadromous fishes in addition to the strictly freshwater fishes. The freshwater fish fauna recorded to date includes 46 spp. in 18 families, of which 5 are introduced forms. A bibliography of about 70 titles and various distributional tables are included.

3356. Bossanyi, J. 1959. A SIMPLE APPARATUS FOR ROUTINE ZOOPLANKTON COUNTS. *J. Cons. int. Explor. Mer.* 24, 452-454; *Water Pollution Abstracts*, Vol. 33, No. 2, Abst. No. 270, 1960.

An illustrated description is given of the design and operation of a simple apparatus for the routine counting of large numbers of easily identifiable zooplankton. It involves the flow of a controllable current of water carrying the preserved organisms through a suitably illuminated counting cell beneath the microscope objective.

3357. Cushing, D. H. 1959. THE SEASONAL VARIATION IN OCEANIC PRODUCTION AS A PROBLEM IN POPULATION DYNAMICS. *J. Cons. int. Explor. Mer.* 24, 455-464; *Water Pollution Abstracts*, Vol. 33, No. 2, Abst. No. 271, 1960.

A biological model of plankton production in temperate seas is described. Certain simplifications are made, the algal community being treated as a single prey and the zooplankton community as a predator. Considered as a predator-prey process, there is a delay period to the grazing capacity of the herbivores. Eggs cannot be produced until a threshold in algal food is reached, and then the eggs take about 3 weeks to develop into animals of significant grazing capacity. During this delay period algal numbers increase by 100 to 1000 times; this outburst is finally controlled by herbivore grazing, which is in excess of the animals'

immediate needs. It is suggested that the decline in nutrients in sea water in the spring takes place just after the algal outburst, when most nutrient is being transferred to herbivore flesh and the gap between uptake and regeneration is greatest. It is suggested that seasonal patterns of production differ mainly in the length of the delay period which increases with latitude.

3358. Anonymous. 1959. FOYLE FISHERIES COMMISSION SEVENTH ANNUAL REPORT. H. M. Stationery Office, Belfast, 1959, 34 pp; Water Pollution Abstracts, Vol. 33, No. 2, Abst. No. 273. 1960.

The report of the Foyle Fisheries Commission for the year ended 30th September 1958, contains information on the conservancy and management of the fisheries in the area. The state of the fisheries is summarized. The Commission has co-operated with the Ministry of Health in discussing schemes for sewerage and water abstraction in the area, to ensure that fish life will not be affected. Industrial concerns near the rivers have also co-operated with the Commission as regards the treatment and discharge of trade effluents. Research on salmon and sea trout in the river Foyle is summarized in an appendix, and a map of the Commission's area is included.

3359. Anonymous. 1959. EAST AFRICAN FISHERIES RESEARCH ORGANIZATION ANNUAL REPORT, 1958. East Africa High Commission, 50 pp.; Water Pollution Abstracts, Vol. 33, No. 2, Abst. No. 274. 1960.

The report of the East African Fisheries Research Organization for 1958 contains information on the scientific work of the Organization, including a brief review of work carried out since the laboratory was established ten years ago, summarizing the results of hydrological studies on lakes and swamps, and surveys of plankton, invertebrates, fish, and other vertebrates. Special consideration is given to the fisheries of lake Victoria. Papers on the following subjects are given in appendices: the food of non-cichlid fishes in lake Victoria; the culture of *Tilapia nigra* in ponds; the growth of *Tilapia* species, including the effect of temperature; and the effect of lake mud as a fertilizer.

3360. Cren, E. D. L. 1958. THE APPLICATION OF SCIENCE TO INLAND FISHERIES. U. N. Fd Agric. Org., FAO Fish. Stud. No. 8, 56 pp.; Water Pollution Abstracts, Vol. 33, No. 2, Abst. No. 275. 1960.

The author reviews the biological bases of fish production in inland waters, and summarizes briefly the main aspects of research in limnology and fishery biology. A selected list of 34 references is appended.

3361. Grim, J. 1958. INVESTIGATIONS AND EXPERIMENTS ON FLOW-THROUGH PHENOMENA IN IMPOUNDING RESERVOIRS. Gas- u. Wasser-fach, 1958, 99, 1078-1079; Water Pollution Abstracts,

Vol. 33, No. 2, Abst. No. 311. 1960.

The depth at which water of a feeding stream flows through an impounding reservoir can at favourable times be determined by addition of colour, salt, or radioactive substances. The path and rate of flow cannot always be so easily ascertained. Results are given for measurement of rate of flow and observation of the path of the stream in different reservoirs. Investigations in the Kerspe reservoir showed a definite connection between sudden high flows and increases in bacterial content of the water at the dam wall. Records exist for this reservoir of daily rainfall, influent, and bacterial numbers of inflowing water and the surface water at the dam wall. The time lag between the inflow of high water and a rise in bacterial numbers at the dam wall is long when there is no stratification in the reservoir and short when the stream water flows in a definite layer at the surface, on the old stream bed, or intermediately. Flow-through times determined by this method and by colour and salt experiments are in good agreement.

3362. Husek, R. S. 1958. THE ROLE OF CILIATE ANALYSIS IN THE BIOLOGICAL CONTROL OF STREAM POLLUTION. Verh. int. Ver. Limnol., 1958, 13, 636-645; Water Pollution Abstracts, Vol. 33, No. 1, Abst. No. 72. 1960.

From studies of indicator organisms of the saprobic system, the author has developed a simplified system of analysis using ciliates as indicator organisms. He gives an account of the ciliates typical of the different saprobic grades and discusses, with examples, the requirements for practical use of the saprobic system, and methods of analysis.

3363. Anonymous. 1959. CONTINUOUS MEASUREMENT OF OXYGEN DISSOLVED IN WATER. Regelungstechnik, Munich, Germany, 1959, 7, 253; Water Pollution Abstracts, Vol. 33, No. 1, Abst. No. 93. 1960.

An instrument for the continuous automatic measurement of dissolved oxygen operates on the chemical reaction between oxygen and nitric oxide. Nitric oxide is added to the water sample in excess so that all the oxygen is converted to nitrous acid. Nitrous acid has a specific electrical conductivity and as its amount is directly proportional to the amount of dissolved oxygen variation in the electrical conductivity is an accurate indication of variation in the concentration of dissolved oxygen. The apparatus is illustrated.

3364. Gaufin, A. R. 1957. THE USE AND VALUE OF AQUATIC INSECTS AS INDICATORS OF ORGANIC ENRICHMENT. Biological Problems in Water Pollution, Robert A. Taft Sanitary Engineering Centre, Cincinnati, Ohio, 1957, 136-143; Water Pollution Abstracts, Vol. 33, No. 1, Abst. No. 183. 1960.

The author discusses the use and value of aquatic insects as indicators of river pollution. In general a population containing numerous gill-breathing forms, such as mayflies, stoneflies and caddis flies, is indicative of clean water conditions while their absence

denotes abundance of organic material and/or low oxygen concentration. By contrast, associations of organisms engaged in the utilization of excess organic materials are characterized by few species but large numbers of individuals. The association of organisms normally present under the most septic conditions consists largely of scavengers, with few plant and animal eaters. The macro-invertebrates most characteristic of septic zones are those which can exist under conditions of very low oxygen concentration or have adaptations for breathing atmospheric oxygen. Thus by reference to the qualitative and quantitative composition of an aquatic population as an index of water quality, it is possible to identify the different zones in a polluted stream.

3365. Ingram, W. M. 1957. USE AND VALUE OF BIOLOGICAL INDICATORS OF POLLUTION: FRESH WATER CLAMS AND SNAILS. Biological Problems in Water Pollution, Robert A. Taft Sanitary Engineering Centre, Cincinnati, Ohio, 1957, 94-135; Water Pollution Abstracts, Vol. 33, No. 1, Abst. No. 184. 1960.

The author outlines investigations into the survival of water clams and snails under septic conditions resulting from sewage pollution. The presence of certain Sphaeriidae and pulmonate snails indicates pollution whereas Unionidae and gill-breathing snails are found generally only under non-polluted conditions. A bibliography of 85 references is appended.

3366. Wuhrmann, K., and H. Woker. 1958. POISONING OF AQUATIC FAUNA BY POLLUTION OF WATERS. Verh. int. Ver. Limnol., 1958, 13, 557-583; Water Pollution Abstracts, Vol. 33, No. 1, Abst. No. 185. 1960.

The authors survey, from the literature and from their own experience, the causes and course of toxic reactions in waters, the application of the results of laboratory experiments to natural conditions, and the relative sensitivity of different types of water fauna. The difference between acute and chronic poisoning, the use of the "manifestation" or "over-turning" time in fish and the immobilization time in lower animals as criteria, natural production of toxic substances in water, and the difference in the effect of discharges into flowing and stagnant waters are discussed. The authors then consider the course of action of poisons, the application and statistical examination of the results of experiment, characterization of poisons by the construction of concentration-effect curves, the choice of suitable animals for experimental purposes, ecological factors which should be considered in laboratory experiments, and the effect of the natural habitat of an animal and its behaviour on contact with poisonous water on the effect of the poison. Among the conclusions drawn are that if ecological conditions and natural habitat are taken into account, results of laboratory experiments can be applied to open waters or, inversely, poisoning in natural conditions can be reconstructed experimentally; the relative sensitivity of lower fauna

varies according to the action of the poison and the physiology of the animal to a much greater extent than in the case of fish; the natural habitat influences the poison reaching the animal; and the repopulation of a damaged habitat depends on the stage of development and mobility of individual types. A bibliography is appended.

3367. Geyer, R. 1958. IMPORTANT POINTS IN SUITABLE SAMPLING OF WATER IN CASES OF DESTRUCTION OF FISH. Dtsch. Fisch. Ztg., 1958, 5, 208-211; Water Pollution Abstracts, Vol. 33, No. 1, Abst. No. 195. 1960.

The author gives, with examples, information on the sampling of water in cases of death of fish due to waste waters. Correct choice of sampling point and full information of local conditions and the type of waste water (if known) considerably ease the work of the chemist and lead to more reliable results with less delay.

3368. Davison, R. C., W. P. Breese, C. E. Warren and P. Doudoroff. 1959. EXPERIMENTS ON THE DISSOLVED OXYGEN REQUIREMENTS OF COLD-WATER FISHES. Sewage industr. Wastes, 1959, 31, 950-966; Water Pollution Abstracts, Vol. 33, No. 1, Abst. No. 197. 1960.

Detailed studies are in progress on the oxygen requirements of fish, and the results are given of some experiments on the effect of temperature on the minimum oxygen concentrations necessary for survival of fasting juvenile coho salmon, *Oncorhynchus kisutch*, for moderately prolonged periods of exposure; on the long-term survival, food consumption, and growth of juvenile coho salmon at low oxygen concentrations; on the influence of sulphite cellulose waste waters, in concentrations well above those usually found in streams in the Pacific Northwest, on the resistance of coho salmon to oxygen deficiency; and on the resistance for periods of 1-5 days of the sculpin, *Cottus perplexus*, to low oxygen concentrations at summer temperatures of 18°-19°C. Experimental procedure is described and the apparatus used is illustrated. In experiments in the autumn, the minimum oxygen concentrations tolerated for 1 day by juvenile coho salmon were found to change little with changes in temperature between 12° and 20°C, but increased markedly at temperatures approaching the upper limit of thermal tolerance of the fish. At temperatures of 20°C or less in summer and autumn, fasting juvenile coho salmon could tolerate for 1 day oxygen concentrations below 2 mg per litre, but not as low as 1 mg per litre. The one-day tolerance limits did not appear to differ from corresponding limits of tolerance for longer exposure periods up to 5 days, as in the longer tests most of the observed mortality at critical oxygen concentrations occurred during the first day of exposure. Most yearling coho salmon tested in winter survived for 30 days at temperatures near 18°C with oxygen concentrations of about 2 mg per litre, but they were sluggish, consumed little food, and lost weight during the test; at oxygen concentrations of about 2.9 mg per litre the fish fed well. The presence of 1200 mg per litre of sulphite cellulose waste waters containing 10 per cent

solids had no noticeable effect on the minimum oxygen requirements of juvenile coho salmon. The resistance of the sculpin to reduced oxygen concentrations at temperatures of 18°-19°C was simi-

lar to that of juvenile coho salmon, but sculpins which survived critical oxygen levels for one day often succumbed to these levels within three or four days.

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